



Washington State
School Seismic Safety Assessments Project

BURLINGTON-EDISON HIGH SCHOOL GYM/FIELDHOUSE BUILDING

Burlington-Edison School District 100

SEISMIC UPGRADES CONCEPT DESIGN REPORT

June 2021

PREPARED FOR



PREPARED BY



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architecture planning interiordesign



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WASHINGTON STATE SCHOOL SEISMIC SAFETY ASSESSMENTS PROJECT

SEISMIC UPGRADES CONCEPT DESIGN REPORT Burlington-Edison High School – Gym/Fieldhouse Building Burlington-Edison School District 100

June 2021

Prepared for:

State of Washington
Department of Natural Resources and Office of Superintendent of Public Instruction

Prepared by:

Brian Y. Matsumoto, P.E., S.E.
Reid Middleton, Inc.



728 134th Street SW, Suite 200
Everett, WA 98204
425-741-3800
File No. 262019.082
www.reidmiddleton.com

Contributions by:



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EXECUTIVE SUMMARY

This report documents the findings of a seismic evaluation of the Burlington-Edison High School Gym/Fieldhouse in Burlington, Washington. The school building has three separate wings with a total of 50,000 square feet of floor area. The original portion of the structure, which consists of a gym and band room, was built in the early 1950s. A wrestling room and weight room were added in the 1970s. A second gymnasium was added as an addition in the 1980s. Each wing of the existing building has reinforced masonry shear walls. However, the 1950s portion of the building also has wood shear walls in addition to the masonry shear walls. The 1950s and 1970s portions of the building have wood roof diaphragms, while the 1980s portion of the building has open-web steel joists and a metal deck roof diaphragm. The 1950s portion of the structure is founded on pile foundations, while the other portions of the building are founded on shallow strip and spread footing foundations.

Reid Middleton performed a Tier 1 screening in accordance with the ASCE 41-17 standard *Seismic Evaluation and Retrofit of Existing Buildings*. The evaluation included field observations and review of record drawings to verify the existing construction. The structural seismic evaluation indicated that the building has multiple seismic deficiencies; the most susceptible ones being in-plane and out-of-plane diaphragm-to-wall anchorage, continuous diaphragm cross-ties, and long span wood diaphragms that consist of diagonal or straight sheathing.

Conceptual seismic upgrade recommendations for the structural systems are provided to improve the performance of the building to meet the Life Safety structural performance objective criteria of ASCE 41-17. Sketches for the concept-level seismic upgrades are provided in Appendix B. The structural upgrades include adding plywood overlays to wood roof diaphragms, increasing the strength of roof diaphragm-to-wall connections, adding continuous diaphragm cross ties, and upgrading wood walls to structural wood shear walls. The recommendations for nonstructural upgrades are to brace fall prone contents and tall narrow contents, such as bookshelves, and to further investigate the design and anchorage of the building's chimney, the building's emergency power system, the building's natural gas piping (and whether there are adequate seismic shut-off valves and flexible couplings), and fall-prone and tall, narrow mechanical/electrical equipment.

An opinion of probable construction costs is provided in Appendix C. It is our opinion that the total cost (construction costs plus soft costs) to upgrade the structure would range between \$5.0M and \$9.37M, with the baseline estimated total cost being \$6.25M. Note however that this estimated cost and cost range could be significantly higher if the presence of liquefiable soils is discovered and requires ground improvements on the Burlington-Edison High School campus to mitigate post-earthquake liquefaction settlement. A detailed geotechnical investigation is also recommended prior to doing a seismic upgrade design project.

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Acronyms

AACE	Association for the Advancement of Cost Engineering
ADA	Americans with Disabilities Act
ASCE	American Society of Civil Engineers
A-E	Architect-Engineer
BPOE	Basic Performance Objective for Existing Buildings
BSE	Basic Safety Earthquake
CMU	Concrete Masonry Unit
CP	Collapse Prevention
DNR	Department of Natural Resources
DCR	Demand-to-Capacity Ratio
EERI	Earthquake Engineering Research Institute
EPAT	EERI Earthquake Performance Assessment Tool
FEMA	Federal Emergency Management Agency
GC/CM	General Contractor / Construction Manager
GWB	Gypsum Wallboard
IBC	International Building Code
ICOS	Information and Condition of Schools
IEBC	International Existing Building Code
IO	Immediate Occupancy
LS	Life Safety
MCE	Maximum Considered Earthquake
MEP	Mechanical/Electrical/Plumbing
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
OSPI	Office of Superintendent of Public Instruction
PBEE	Performance-Based Earthquake Engineering
PR	Position Retention
ROM	Rough Order-of-Magnitude
SSSSC	School Seismic Safety Steering Committee
UBC	Uniform Building Code
URM	Unreinforced Masonry
USGS	United States Geological Survey
WF	Wide Flange
WGS	Washington Geological Survey
WSSSSAP	Washington State School Seismic Safety Assessments Project

Reference List

Codes and References

2018 IBC, *2018 International Building Code*, prepared by the International Code Council, Washington, D.C.

AACE International Recommended Practice No. 56R-08, 2020, *Cost Estimate Classification System*, prepared by the Association for the Advancement of Cost Engineering International, Fairmont, West Virginia.

ASCE 7-16, 2017, *Minimum Design Loads for Buildings and Other Structures*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

ASCE 41-17, 2017, *Seismic Evaluation and Retrofit of Existing Buildings*, prepared by the Structural Engineering Institute of the American Society of Civil Engineers, Reston, Virginia.

FEMA E-74, 2011, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, prepared by Applied Technology Council, Redwood City, California.

Structural Engineers of Northern California, 2017, Earthquake Performance Rating System ASCE 41-13 Translation Procedure: The Buildings Ratings Committee, a sub-committee of the Existing Buildings Committee of The Structural Engineers Association of Northern California.

Structural Engineers of Northern California, 2015, Earthquake Performance Rating System User's Guide: The Buildings Ratings Committee, a sub-committee of the Existing Buildings Committee of The Structural Engineers Association of Northern California.

Drawings

Galen W. Bentley Architect, April 1953, existing drawings titled "Burlington-Edison High School Physical Education Building," Burlington, Washington

Botesch-Nash and Associates Architects and Engineers, 1973, existing drawings titled "Alternations & Additions to the Burlington-Edison High School," Burlington, Skagit County, Washington

Botesch, Nash and Hall Architects, April 1985, existing drawings titled "High School New Field House, Burlington-Edison School District 100," Burlington, Washington

1.0 Introduction

1.1 Background

In 2018-2019, the Washington Geological Survey (WGS), a division of the Department of Natural Resources (DNR), led a Washington State School Seismic Safety Assessments Project (WSSSSAP) that seismically and geologically screened 222 school buildings and 5 fire stations across Washington State to better understand the current level of seismic risk of Washington State's public-school buildings. This first phase of the WSSSSAP was executed with the help of Washington State's Office of Superintendent of Public Instruction (OSPI) and Reid Middleton, along with their team of structural engineers, architects, and cost estimators.

Building upon the success of Phase 1, WGS, OSPI, and Reid Middleton's team embarked on phase 2 of this project to seismically and geologically screen another 339 school buildings and 2 fire stations, mostly located in the high-seismic risk regions of Washington State. Similar to Phase 1, the two main components of Phase 2 of this seismic safety assessments project are: (1) geologic site characterization, and (2) the seismic assessment of buildings. As a part of the seismic assessments, Tier 1 screening of structural systems and nonstructural assessments were performed in accordance with the American Society of Civil Engineers' (ASCE) Standard 41-17 *Seismic Evaluation and Retrofit of Existing Buildings*. Concept-level seismic upgrades were developed to address the identified deficiencies of a select number of school buildings to evaluate seismic upgrade strategies, feasibilities, and implementation costs.

Seventeen school buildings were selected in consultation with WGS and Office of Superintendent of Public Instruction (OSPI) to receive concept-level seismic upgrade designs utilizing the ASCE 41 Tier 1 evaluation results. This report documents the concept-level seismic upgrade design for one of those school buildings. The concept-level seismic upgrades will include structural and nonstructural seismic upgrade recommendations, with concept-level sketches and rough order-of-magnitude (ROM) construction costs determined for each building. The seventeen school buildings were selected from the list of schools with the intent of representing a variety of regions, building uses, construction eras, and construction materials.

The overall goal of the project is to provide a better understanding of the current seismic risk of our state's K-12 school buildings and what needs to be done to improve the buildings in accordance with ASCE 41 to meet seismic performance objectives.

The seismic evaluation consists of a Tier 1 screening for the structural systems performed in accordance with ASCE 41-17.

1.2 Scope of Services

The project is being performed in several distinct and overlapping phases of work. The scope of this report is as listed in the following sections.

1.2.1 Information Review

1. Project Research: Reid Middleton and their project team researched available school building records, such as relevant site data and record drawings, in advance of the field investigations. This research included searching school building records and contacting the districts and/or the Office of Superintendent of Public Instruction (OSPI) to obtain building plans, seismic reports, condition reports, or related construction information useful for the project.
2. Site Geologic Data: Site geological data provided by the WGS, including site shear wave velocities, was utilized to determine the project Site Class in accordance with ASCE 41, which is included in the Tier 1 checklists and concept-level seismic upgrades design work.

1.2.2 Field Investigations

1. Field Investigations: Each of the identified buildings was visited to observe the building's age, condition, configuration, and structural systems for the purposes of the ASCE 41 Tier 1 seismic evaluations. This task included confirmation of general information in building records or layout drawings and visual observation of the structural condition of the facilities. Engineer field reports, notes, photographs, and videos of the facilities were prepared and utilized to record and document information gathered in the field investigation work.
2. Limitations Due to Access: Field observation efforts were limited to areas and building elements that were readily observable and safely accessible. Observations requiring access to confined spaces, potential hazardous material exposure, access by unsecured ladder, work around energized equipment or mechanical hazards, access to areas requiring Occupational Safety and Health Administration (OSHA) fall-protection, steep or unstable slopes, deteriorated structural assemblies, or other conditions deemed potentially unsafe by the engineer were not performed. Removal of finishes (e.g., gypsum board, lath and plaster, brick veneer, roofing materials) for access to concealed conditions or to expose elements that could not otherwise be visually observed and assessed was not performed. Material testing or sampling was not performed. The ASCE checklist items that were not documented due to access limitations are noted.

1.2.3 Seismic Evaluations and Conceptual Upgrades Design

1. Seismic Evaluations: Limited seismic assessments of the structural and nonstructural systems of the school buildings were performed in accordance with ASCE 41-17 Tier 1 Evaluation Procedures.
2. Conceptual Upgrades Design: Further seismic evaluation work was performed to provide concept-level seismic retrofits and/or upgrade designs for the selected school buildings based on the results of the Tier 1 seismic evaluations. The concept-level seismic upgrades design work included narrative descriptions of proposed seismic retrofits and/or

upgrade schemes and concept sketches depicting the extent and type of recommended structural upgrades.

3. Architectural Review: The seismic upgrade concept developed by the structural engineers was reviewed by Dykeman Architects for general guidance and consideration of the architectural aspects of the seismic upgrade. The architects discussed the seismic upgrade concepts with the structural engineer and reviewed existing drawings that were available, pictures taken during the engineer's field investigations, and the ASCE 41 Tier 1 Screening reports. However, field visits by the architect and meetings with the school district and facilities personnel to discuss phasing and programming requirements were not included in the project scope of work. The architectural considerations are discussed in Section 4.4 Nonstructural Recommendations and Considerations. These conceptual designs were reviewed with high-level recommendations. Future planning for seismic improvements should include further review with a design team.
4. Cost Estimating: Through the concept-level seismic upgrades report process, ProDims, LLC, provided opinions of probable construction costs for the concept-level seismic upgrade designs for the selected school buildings. These concept-level seismic upgrade designs and the associated opinions of probable construction costs are intended to be representative samples that can be extrapolated to estimate the overall capital needs of seismically upgrading Washington State schools.

1.2.4 Reporting and Documentation

1. Conceptual Upgrade Design Reports: Buildings that were selected to receive a conceptual upgrade design will have a report prepared that will include an introduction summarizing the overall findings and recommendations, along with individual sections documenting each building's seismic evaluation, list of deficiencies, conceptual seismic upgrade sketches and opinions of probable construction costs.
2. Building Photography: Photos were taken of each building during on-site walkthroughs to document the existing building configurations, conditions, and structural systems. These are available upon request through DNR/WGS.
3. Existing Drawings: Select and available existing drawings and other information were collected during the evaluation process. These are available upon request through DNR/WGS.

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2.0 Seismic Evaluation Procedures and Criteria

2.1 ASCE 41 Seismic Evaluation and Retrofit Overview

The current standard for seismic evaluation and retrofit (upgrades) of existing buildings is ASCE 41-17. ASCE 41 provides screening and evaluation procedures used to identify potential seismic deficiencies that may require further investigation or hazard mitigation. It presents a three-tiered review process, implemented by first following a series of predefined checklists and “quick check” structural calculations. Each successive tier is designed to perform an increasingly refined evaluation procedure for seismic deficiencies identified in previous tiers in the process. The flow chart in Figure 2.1 illustrates the evaluation process.

TIER 1 – Screening Phase

- Checklists of evaluation statements to quickly identify potential deficiencies
- Requires field investigation and/or review of record drawings
- Analysis limited to “Quick Checks” of global elements
- May proceed to Tier 2, Tier 3, or rehabilitation design if deficiencies are identified

TIER 2 – Evaluation Phase

- “Full Building” or “Deficiency Only” evaluation
- Address all Tier 1 seismic deficiencies
- Analysis more refined than Tier 1, but limited to simplified linear procedures
- Identify buildings not requiring rehabilitation

TIER 3 – Detailed Evaluation Phase

- Component-based evaluation of entire building using reduced ASCE 41 forces
- Advanced analytical procedures available if Tier 1 and/or Tier 2 evaluations are judged to be overly conservative
- Complex analysis procedures may result in construction savings equal to many times their cost

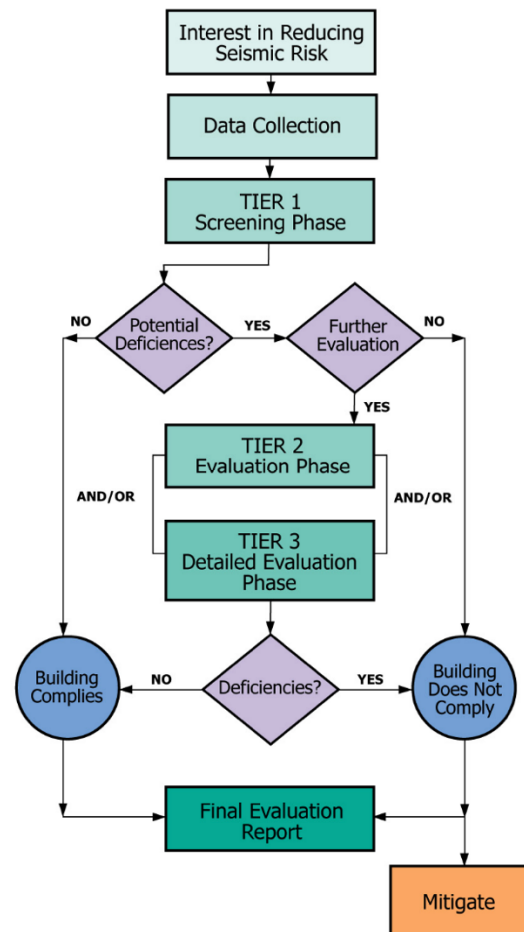


Figure 2-1. Flow Chart and Description of ASCE 41 Seismic Evaluation Procedure.

The Tier 1 checklists in ASCE 41 are specific to each common building type and contain seismic evaluation statements based on observed structural damage in past earthquakes. These checklists screen for potential seismic deficiencies by examining the lateral-force-resisting systems and details of construction that have historically caused poor seismic performance in similar buildings. Tier 1 screenings include basic “Quick Check” analyses for primary components of

the lateral system. Tier 1 screenings also include prescriptive checks for proper seismic detailing of connections, diaphragm spans and continuity, and overall system configuration.

Tier 2 evaluations then follow with more-detailed structural and seismic calculations and assessments to either confirm the potential deficiencies identified in the Tier 1 review or demonstrate their adequacy. A Tier 3 evaluation involves an even more detailed analysis and advanced structural and seismic computations to review each structural component's seismic demand and capacity. A Tier 3 evaluation is similar in scope and complexity to the types of analyses often required to design a new building in accordance with the International Building Code (IBC), with a comprehensive analysis aimed at evaluating each component's seismic performance. Generally, Tier 3 evaluations are not practical for typical and regular-type buildings due to the rigorous and complicated calculations and procedures. As indicated in the Scope of Services, this evaluation included a Tier 1 screening of the structural systems.

2.2 Seismic Evaluation and Retrofit Criteria

Performance-Based Earthquake Engineering (PBEE) can be defined as the engineering of a structure to resist different levels of earthquake demand in order to meet the needs and performance objectives of building owners and other stakeholders. ASCE 41 employs a PBEE design methodology that allows building owners, design professionals, and the local building code authorities to establish seismic hazard levels and performance goals for individual buildings.

2.2.1 Site Class Definition

The building site class definition quantifies the site soil's propensity to amplify or attenuate earthquake ground motion propagating from underlying rock. Site class has a direct impact on the seismic design forces utilized to design and evaluate a structure. There are six distinct site classes defined in ASCE 7-16, Site Class A through Site Class F, that range from hard rock to soils that fail such as liquefiable soils. Buildings located on soft or loose soils will typically sustain more damage than similar buildings located on stiff soils or rock, all other things being equal. The Washington State Department of Natural Resources measured the time-averaged shear-wave velocity at each site to 30 meters (100 feet) below the ground surface, V_{s30} . This measured shear-wave velocity was used to determine the site class. The site for this building was determined to be **Site Class D**.

2.2.2 Burlington-Edison High School Seismicity

Seismic hazards for the United States have been quantified by the United States Geological Survey (USGS). The information has been used to create seismic hazard maps, which are currently used in building codes to determine the design-level earthquake magnitudes for building design.

The Level of Seismicity is categorized as Very Low, Low, Moderate, or High based on the probabilistic ground accelerations. Ground accelerations and mass generate inertial (seismic) forces within a building ($\text{Force} = \text{mass} \times \text{acceleration}$). Ground acceleration therefore is the

parameter that classifies the level of seismicity. From geographic region to region, as the ground accelerations increase, so does the level of seismicity (from low to high). Where this building is located, the design short-period spectral acceleration, S_{DS} , is 0.757 g, and the design 1-second period spectral acceleration, S_{D1} , is 0.481 g. Based on ASCE 41 Table 2-4, the Level of Seismicity for this building is classified as **High**.

The ASCE 41 Basic Performance Objective for Existing Buildings (BPOE) makes use of the Basic Safety Earthquake – 1E (BSE-1E) seismic hazard level and the Basic Safety Earthquake – 2E (BSE-2E). The BSE-1E earthquake is defined by ASCE 41 as the probabilistic ground motion with a 20 percent probability of exceedance in 50 years, or otherwise characterized as a ground motion acceleration with a probabilistic 225-year return period. The BSE-2E earthquake is defined by ASCE 41 as the probabilistic ground motion with a 5 percent probability of exceedance in 50 years, or otherwise characterized as a ground motion acceleration with a probabilistic 975-year return period. The BSE-2N seismic hazard level is the Maximum Considered Earthquake (MCE) ground motion used in current codes for the design of new buildings and is also used in ASCE 41 to classify the Level of Seismicity for a building. The BSE-2N has a statistical ground motion acceleration with 2 percent probability of exceedance in 50 years, or otherwise characterized as a ground motion acceleration with a probabilistic 2,475-year return period.

Table 2.2.1-1 provides the spectral accelerations for the 225-year, 975-year, and 2,475-year return interval events specific to Burlington-Edison High School that are considered in this study.

Table 2.2.1-1. Spectral Acceleration Parameters (Site Class D).

BSE-1E 20%/50 (225-year) Event		BSE-1N 2/3 of 2,475-year Event		BSE-2E 5%/50 (975-year) Event		BSE-2N 2%/50 (2,475-year) Event	
0.2 Seconds	0.561 g	0.2 Seconds	0.757 g	0.2 Seconds	0.931 g	0.2 Seconds	1.136 g
1.0 Seconds	0.284 g	1.0 Seconds	0.481 g	1.0 Seconds	0.567 g	1.0 Seconds	0.721 g

2.2.3 Burlington-Edison High School Structural Performance Objective

The school building is an Educational Group E occupancy (Risk Category III) structure and has not been identified as a critical structure requiring immediate use following an earthquake. However, Risk Category III buildings are structures that represent a substantial hazard to human life in the event of failure. According to ASCE 41, the BPOE for Risk Category III structures is the Damage Control structural performance level at the BSE-1E seismic hazard level and the Limited Safety structural performance level at the BSE-2E seismic hazard level. The ASCE 41 Tier 1 evaluations were conducted in accordance with ASCE 41 requirements and ASCE 41 seismic performance levels. Concept-level upgrades were developed for the **Life Safety** structural performance level at the **BSE-1N** seismic hazard level in accordance with DNR direction, the project scope of work, and the project legislative language.

At the Life-Safety performance level, the building may sustain damage while still protecting occupants from life-threatening injuries and allowing occupants to exit the building. Structural and nonstructural components may be extensively damaged, but some margin against the onset of partial or total collapse remains. Injuries to occupants or persons in the immediate vicinity may occur during an earthquake; however, the overall risk of life-threatening injury as a result of structural damage is anticipated to be low. Repairs may be required before reoccupying the building, and, in some cases, repairs may be economically unfeasible.

Knowledge Factor

A knowledge factor, k , is an ASCE 41 prescribed factor that is used to account for uncertainty in the as-built data considering the selected Performance Objective and data collection processes (availability of existing drawings, visual observation, and level of materials testing). No in-situ testing of building materials was performed; however, some material properties and existing construction information were provided in the existing record drawings. If the concept design is developed further, additional materials tests and site investigations will be required to substantiate assumptions about the existing framing systems.

ASCE 41 Classified Building Type

Use of ASCE 41 for seismic evaluations requires buildings to be classified from a group of common building types historically defined in previous seismic evaluation standards (ATC-14, FEMA 310, and ASCE 31-03). Most of the building is classified by ASCE 41 Table 3-1 as a reinforced masonry shear wall building with flexible diaphragms, **RM1**. However, part of the building is classified as a wood-framed shear wall building, **W2**. Reinforced masonry shear wall buildings (RM1) include those that have bearing shear walls constructed of reinforced masonry with elevated floor and roof framing structural systems consisting of wood framing or steel framing with metal deck. Wood-framed shear wall buildings include those with light-framed wood walls with sheathing and wood floors and roofs with structural sheathing.

2.3 Report Limitations

The professional services described in this report were performed based on available record drawing information and limited visual observation of the structure. No other warranty is made as to the professional advice included in this report. This report provides an overview of the seismic evaluation results and does not address programming and planning issues. This report has been prepared for the exclusive use of DNR/WGS and is not intended for use by other parties, as it may not contain sufficient information for purposes of other parties or their uses.

3.0 Building Description & Seismic Evaluation Findings

3.1 Building Overview

3.1.1 Building Description

Original Year Built: 1953
Building Code: 1952 UBC

Number of Stories: 1
Floor Area: 50,133 SF

FEMA Building Type: RM1
ASCE 41 Level of Seismicity: High
Site Class: D



The Fieldhouse at Burlington-Edison High School is a single-story, 50,000-square-foot building that houses two gymnasiums, a wrestling room, locker rooms, a weight lifting room, and some classroom space. The building footprint is approximately 300 feet by 180 feet. Building framing in the original 1953 gym consists of masonry and concrete perimeter walls with a steel and wood roof. The building framing in the 1973 addition consists of masonry walls and wood and steel roof framing. The building framing in the 1985 addition consists of masonry walls with a wood and steel roof.

3.1.2 Building Use

The Fieldhouse contains several gym and physical education spaces, as well as a band room.

3.1.3 Structural System

Table 3.1.3-1. Structural System Descriptions.

Structural System	Description
Structural Roof	The roof framing over the 1953 gym consists of 1-inch diagonal wood sheathing over 2x12 wood joists spanning between arched glulam beams members and concrete walls. The roof at the northeast corner consists of concrete slabs and beams spanning between concrete walls. The remaining roof framing around the gym consists of 1-inch diagonal sheathing over 2x12 wood joists spanning between steel beams, concrete walls, and masonry walls.

Table 3.1.3-1. Structural System Descriptions.

Structural System	Description
	<p>The roof framing over the 1973 addition consists of 2x6 tongue-and-groove decking over glulam beams supported by steel columns and concrete masonry unit (CMU) walls.</p> <p>The roof framing over the 1985 addition consists of metal deck over open-web steel joists spanning between masonry walls. The roof framing at the north side of the addition consists of 1/2-inch plywood sheathing over wood trusses spanning between masonry walls.</p>
Structural Floor(s)	<p>The floor framing at the 1953 gym consists of 1-inch diagonal wood sheathing over 2x10 wood joists spanning between wood beams supported on concrete plinths over pile caps. The remaining floor framing around the gym consists of concrete slabs spanning over concrete beams supported by concrete plinths over pile caps.</p> <p>The floor framing of the 1973 addition consists of a concrete slab on grade.</p> <p>The floor framing at the 1985 addition consists of a concrete slab on grade and an elevated floor deck at the northeast corner consisting of 3/4-inch plywood sheathing over TJI joists spanning between CMU walls.</p>
Foundations	<p>The foundation of the 1953 gym consists of wood piles tied together with concrete grade beams and pile caps.</p> <p>The foundation of the 1973 addition consists of continuous footings under the masonry walls and pad footings below the steel columns.</p> <p>The foundation of the 1985 addition consists of continuous footings under the masonry walls.</p>
Gravity System	<p>The gravity system in the 1953 gym consists of roof framing supported by concrete and masonry walls and concrete plinths.</p> <p>The gravity system of the 1973 addition consists of roof framing supported by masonry walls and steel columns.</p> <p>The gravity system of the 1985 addition consists of roof and floor framing supported by masonry walls.</p>
Lateral System	<p>The lateral system of the 1953 gym consists a roof diaphragm and perimeter concrete and masonry shear walls.</p> <p>The lateral system of the 1973 addition consists of a roof diaphragm and perimeter masonry walls.</p> <p>The lateral system of the 1985 addition consists of roof and floor diaphragms and perimeter masonry walls.</p>

3.1.4 Structural System Visual Condition

Table 3.1.4-1. Structural System Condition Descriptions.

Structural System	Description
Structural Roof	No visible deterioration or damage was observed.
Structural Floor(s)	No visible deterioration or damage was observed.
Foundations	No visible deterioration or damage was observed.
Gravity System	No visible deterioration or damage was observed.
Lateral System	No visible deterioration or damage was observed.

3.2 Seismic Evaluation Findings

3.2.1 Structural Seismic Deficiencies

The structural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is provided based on this evaluation.

Table 3.2.1-1. Identified Structural Seismic Deficiencies Based on Tier 1 Checklists.

Deficiency	Description
Ties Between Foundation Elements	There are ties between the foundation elements in the 1953 gym; however, in the remaining structure, there are no ties across the building or slab ties indicated in the record drawings. Soils and liquefaction review should be performed to verify capacity of exterior soils to restrain wall movement. Additional foundation ties may be appropriate to mitigate seismic risk.
Spans	The diaphragm for the 1950s portion of the structure has diagonal 1x sheathing and is compliant. However, the 1970s portion of the structure has straight sheathing diaphragm and spans larger than 24 feet. The 1970s portion of the structure is noncompliant with this checklist item. Strengthening of the roof diaphragm may be warranted to increase the building seismic strength.
Cross Ties	The 1950s portion of the building and the 1970s portion of the building do not have continuous cross ties in both direction. The addition of cross ties may be warranted to improve building seismic performance.
Wall Anchorage	The record drawings provided do not show all the details for how the walls are anchored to the diaphragms. Based on the details provided, it is suspected that the wall connections to the diaphragms are not compliant with this checklist item. Increasing the strength of the wall-to-roof

Table 3.2.1-1. Identified Structural Seismic Deficiencies Based on Tier 1 Checklists.

Deficiency	Description
	diaphragm connections may be warranted to improve the building's resistance to earthquakes.
Diagonally Sheathed and Unblocked Diaphragms	The 1950s portion of the building has diagonally sheathed diaphragm roof and spans much more than 40 feet. The 1970s portion of the building has straight-sheathed tongue-and-groove deck diaphragm and spans further than 40 feet. The 1980s portion of the building has a metal deck diaphragm to which this check is not applicable.

3.2.2 Structural Checklist Items Marked as “U”nknown

Where building structural component seismic adequacy was unknown due to lack of available information or limited observation, the structural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown structural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is provided based on the evaluation.

Table 3.2.2-1. Identified Structural Checklist Items Marked as Unknown.

Deficiency	Description
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. Moderate to high liquefaction potential is identified in ICOS based on state geologic mapping. This requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure. The structure appears to be located on a relatively flat site.
Surface Fault Rupture	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.
Load Path and Transfer to Shear Walls	The reinforcing steel in the 1980s gym addition portion of the building is compliant with both the vertical and horizontal reinforcing limits. However, reinforcing information is not shown on the available record drawings for the 1970s portion of the structure. Consequently, the reinforcing steel for this portion of the structure is unknown.

3.2.3 Nonstructural Seismic Deficiencies

Table 3.2.3-1 summarizes the seismic deficiencies in the nonstructural systems. The Tier 1 screening checklists are provided in Appendix A.

Table 3.2.3-1. Identified Nonstructural Seismic Deficiencies based on Tier 1 Checklists.

Deficiency	Description
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	It did not appear that contents taller than 6 feet were adequately restrained. Restraining contents by bracing top of contents to nearest backing wall or providing overturning base restraint may be appropriate to mitigate seismic risk.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H	A number of shelving units appear to support heavy items that do not appear well secured. Heavy items on upper shelves should be restrained by netting or cabling to mitigate seismic risk.

3.2.4 Nonstructural Checklist Items Marked as “U”nknown

Where building nonstructural component seismic adequacy was unknown due to lack of available information or limited observation, the nonstructural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown nonstructural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is provided based on the evaluation.

Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 3.2.4-1. Identified Nonstructural Checklist Items Marked as Unknown.

Deficiency	Description
LSS-3 Emergency Power. HR-not required; LS-LMH; PRLMH.	Emergency power systems were not verified with maintenance or facility staff. Facility staff should verify the use of backup power to control Life Safety systems. If used, further investigation should be performed to determine if seismic anchorage is adequate.
HM-3 Hazardous Material Distribution. HR-MH; LSMH; PR-MH.	The building has natural gas piping. However, the details of how the piping is anchored are not known. Further investigation should be performed to determine if the natural gas piping is seismically adequate.

Table 3.2.4-1. Identified Nonstructural Checklist Items Marked as Unknown.

Deficiency	Description
HM-4 Shutoff Valves. HRMH; LS-MH; PR-MH.	It is unknown whether shut-off valves exist. If they do not exist, installation of shut-off valves may be appropriate to reduce seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PRLMH.	It is unknown whether natural gas piping has flexible couplings. If they do not exist, installation of flexible couplings may be appropriate to reduce seismic risk.
HM-6 Piping or Ducts Crossing Seismic Joints. HRMH; LS-MH; PR-MH.	The building does not have explicit seismic joints, but the building does have different wings built at different times. It is not known if natural gas piping crosses between different wings of the building. Further investigation of the natural gas piping is recommended.
MC-1 URM Chimneys. HRLMH; LS-LMH; PR-LMH.	A large brick masonry chimney exists on the east side of the building. It is not known whether the chimney is reinforced. Further investigation is recommended if it is desired to determine compliance or noncompliance.
MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.	The anchorage of the masonry chimney is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	No existing drawings and inadequate access to verify. Further investigation should be performed.
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H	The types of large equipment and the manner in which the equipment is braced is unknown. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-2 In-Line Equipment. HR- not required; LS-H; PR-H.	The types and locations of in-line equipment (if any) and their bracing are not known. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	The manner in which tall narrow equipment is braced is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.

4.0 Recommendations and Considerations

4.1 Seismic-Structural Upgrade Recommendations

Concept-level seismic upgrade recommendations to improve the lateral-force-resisting system were developed. The sketches in Appendix B depict the concept-level structural upgrade recommendations outlined in this section. The following concept recommendations are intended to address the structural deficiencies noted in Table 3.2.1-1. This concept-level seismic upgrade design represents just one of several alternative seismic upgrade design solutions and is based on preliminary seismic evaluation and analysis results. Final analysis and design for seismic upgrades must include a more detailed seismic evaluation of the building in its present or future configuration. Proposed seismic upgrades include the following.

4.1.1 New Foundation Cross Ties

The 1970s built wrestling and weight room wing and the 1980s built gym addition do not have cross ties at their foundation connecting the existing foundations together. The original 1950s gym wing is founded on piles and already has grade beams connecting foundations. It is recommended that the 1970s and 1980s portions of the building receive added grade beam cross ties at their foundation level to connect the existing foundations together. The cross ties should extend across the entire portion of the building from exterior wall to exterior wall. Demolition of the flooring and slab on grade in the area around the added grade beams will be required. The added grade beams should consist of reinforced concrete and be doveled into the existing slab on grade. The grade beams will need to be doveled into the existing foundations where the existing foundations and new grade beams intersect.

4.1.2 Plywood Overlay on Existing Wood Roof Diaphragms

The existing wood roof diaphragms consist of either 1x diagonal sheathing or 2x6 straight wood decking. Portions of these diaphragms possess relatively long spans and are not as strong as a plywood diaphragm. It is recommended to add a layer of plywood to the roof with typical wood structural diaphragm nailing. The plywood overlay will require the removal of existing roofing materials and insulation in order to apply the new plywood.

4.1.3 Increase Strength of Diaphragm Connections to Walls Below

The building's typical connections from the roof diaphragms to the walls below are recommended to be strengthened. Strengthening may typically include adding wood blocking or continuous wood members, adding light-gauge metal clips and installing post-installed concrete or masonry anchors to strengthen the connection into the masonry or concrete walls below. This work can be completed at the same time as the plywood overlay work, as the work will occur in the same area. This strengthening is recommended for all wings of the building.

4.1.4 Added Roof Diaphragm Cross-Ties

It is recommended that continuous wood cross-ties be added to existing wood diaphragms. The existing wood diaphragms do not currently possess continuous wood crossties that extend from exterior wall to exterior wall. Cross-ties help to transfer exterior wall loads into the roof diaphragm and help prevent the exterior wall from separating from the roof. The diaphragm cross-ties can typically consist of continuous wood beams combined with light-gauge coil straps that provide continuous tension/compression strength to the diaphragm. The cross ties can be added to the roofs at the same time as the other roof work for added efficiency in the construction.

4.1.5 Upgrade Existing Wood Walls to Be Structural Shear Walls

The exterior wood walls of the high-roof portion of the 1950s-built gym currently possess 1x diagonal sheathing on the building exterior. It is recommended that these walls be upgraded to be structural wood shear walls. Upgrading the walls will likely consist of adding structural plywood sheathing on the building exterior and adding horizontal blocking.

4.2 Foundations and Geotechnical Considerations

A detailed geotechnical analysis of the site soils was not included in the scope of this study. As a result, the geotechnical seismic effects on the existing building and its foundations, such as the presence of liquefiable soils and allowable soil bearing pressures, are unknown at this time. Although the current state of Washington liquefaction mapping shows this building is located on soils classified as Site Class D, the Vs30 measurement of 189 m/s (620 ft/s) is near the borderline between Site Class D and Site Class E, where Site Class E is often associated with liquefiable soils. Additionally, based on state of Washington liquefaction mapping, this building is located on soils classified with a moderate to high susceptibility of liquefaction. The presence of liquefiable soils should be further investigated and reviewed by a licensed geotechnical engineer.

Liquefaction is the tendency of certain soils to saturate and lose strength during strong earthquake shaking, causing it to flow and deform similar to a liquid. Liquefaction, when it occurs, drastically decreases the soil bearing capacity and tends to lead to large differential settlement of soil across a building's footprint. Liquefaction can also cause soils to spread laterally and can dramatically affect a building's response to earthquake motions, all of which can significantly compromise the overall stability of the building and possibly lead to isolated or widespread collapse in extreme cases. Existing foundations damaged as a result of liquefiable soils also make the building much more difficult to repair after an earthquake.

Buildings that are not founded on a raft foundation or deep foundation system (such as grade beams and piles), and those with conventional strip footings and isolated spread footings that are not interconnected well with tie beams, are especially vulnerable to liquefiable soils. Mitigation techniques used to improve structures in liquefiable soils vary based on the type and amount of liquefiable soils and may include ground improvements to densify the soil (aggregate piers, compaction piling, jet grouting), installation of additional deep foundations (pin piling, augercast piling, micro-piling), and installation of tie beams between existing footings.

The 1953 area of the gymnasium is founded on wood piles with interconnecting grade beams; however, the 1975 and 1983 areas are founded on conventional spread footings without interior strip footings or tie beams. The soil capacity and pile capacity to resist seismic demands is unknown at this time. It is recommended that a detailed geotechnical study and investigation be completed on the building site to determine the nature of the liquefaction hazard, the characteristics of the site soils, and adequacy of the wood piling. Foundation mitigation and ground improvement may be required, and the recommended geotechnical investigation could have a major impact on the scope of work required for seismic retrofit.

4.3 Tsunami Considerations

The building is not located in a tsunami inundation zone according to Washington State Department of Natural Resources tsunami inundation mapping. It is not necessary to consider tsunamis when planning seismic upgrades to this building.

4.4 Nonstructural Recommendations and Considerations

Table 3.2.3-1 identifies several nonstructural deficiencies that do not meet the performance objective selected for Burlington-Edison High School. It is recommended that these deficiencies be addressed to provide nonstructural performance consistent with the performance of the upgraded structural lateral-force-resisting system. As-built information for the existing nonstructural systems, such as fire sprinklers, mechanical ductworks, and piping, are not available for review. Only limited visual observation of the systems was performed during field investigation due to limited access or visibility to observe existing conditions. The conceptual mitigation strategies provided in this study are preliminary only. The final analysis and design for seismic rehabilitation should include a detailed field investigation.

4.4.1 Architectural Systems

This section addresses existing construction that, while not posing specific hazards during a seismic event, would be affected by the seismic improvements proposed.

For any remodel project of an existing building, the International Existing Building Code (IEBC) would be applicable. The intent of the IEBC is to provide flexibility to permit the use of alternative approaches to achieve compliance with minimum requirements to safeguard the public health, safety, and welfare insofar as they are affected by the work being done.

Energy Code

Elements of the exterior building envelope being affected by the seismic work would also be required to be brought up to the current Washington State Energy Code per Chapter 5, where applicable.

Accessibility

It should also be noted that, as a part of any upgrade to existing buildings, the IEBC will require that any altered primary function spaces (classrooms, gyms, entrances, offices) and routes to these spaces, be made accessible to the current accessibility standards of the Americans with Disabilities Act (ADA), unless technically infeasible. This would include but is not limited to accessible restrooms, paths of travel, entrances and exits, parking, signage, and fire alarm systems. Under no circumstances should the facility be made less accessible. The IEBC does, however, have exceptions for areas that do not contain a primary function (storage room, utility rooms) and states that costs of providing the accessible route are not required to exceed 20 percent of the costs of the alterations affecting the area of Primary Function. As with any major renovation and modernization, an ADA study would be recommended to determine the extent to which an existing facility needs to be improved to be in compliance with the ADA.

Hazardous Materials Survey

It is recommended that all existing construction be surveyed for the presence of hazardous materials. Elements such as floor tile, adhesive, and pipe insulation could contain asbestos. Lead may be present in paint and light fixtures may contain PCB ballasts. A hazardous materials survey and abatement of the buildings should be performed prior to the start of any demolition work.

New Foundation Cross Ties

Installation of new foundation cross ties in the 1970s and 1980s buildings will require removal and replacement of floor finishes and demolition of the slab on grade in the area of work. A cost analysis should be performed to determine whether it is more cost effective to remove the entire slab or just localized portions. The 1970s building appears to have rubber and/or vinyl sheet flooring, which should be replaced in kind, including resilient wall base. In the 1980s building, the existing wood floor system (Gym), VCT flooring, and Ceramic Tile (Locker Rooms) will need to be replaced, including resilient wall base. As the locker rooms have multiple plumbing fixtures, including showers and toilets, a certain amount of plumbing reconfiguration should be anticipated.

Plywood Overlay on Existing Wood Roof Diaphragms

Installation of a new plywood roof diaphragm at the 1950s and 1970s buildings will require removal of the existing roofing material to allow installation of new plywood sheathing. A new roof consisting of a vapor barrier, continuous rigid R-38 insulation, coverboard, and membrane roofing is recommended. It is assumed that the existing parapet flashing may be re-used. At the 1970s building, existing roof insulation is tapered to the exterior wall, where the roofing continues, uninsulated, over exterior canopies. This approach should be verified with the current energy code, and if acceptable, the existing flashing, gutters, and downspouts may remain in place. Any mechanical equipment curbs should be raised to accommodate the thicker insulation.

Verification of Existing Transverse Wood Shear Walls

Where selective demolition of the lower 2 feet of the shear walls is performed, interior finishes should be replaced to match existing, including wall base.

Increase Strength of Diaphragm Connections to Walls Below

Some of the roof-to-wall connection installation may be accomplished from above during the installation of plywood diaphragm; however, some portions of the work must occur from the interior, requiring removal and replacement of approximately 3'-0" of acoustical tile ceiling (where directly applied to deck) and 3'-0" of suspended ceiling system elsewhere. At the 1980s building, installation of a continuous steel channel on top of the masonry wall and beneath the metal roof deck will require patching and painting of the adjacent wall and roof deck.

Added Roof Diaphragm Cross-Ties

Installation of continuous diaphragm cross ties at the 1950s and 1970s roof structure may be accomplished from the interior. New wood cross-ties should be painted.

Upgrade Existing Wood Walls to be Structural Shear Walls

Installation of horizontal blocking and plywood sheathing on the east and west exterior walls of the 1950s building will require removal and replacement of the existing brick veneer to allow access. New R-21 batt insulation should be installed to meet the current energy code.

Contents and Furnishings

Buildings often contain various tall and narrow furniture, such as shelving and storage units, that are freestanding away from any backing walls. High book shelving, for example, can be highly susceptible to toppling if not anchored properly to the backing walls or to each other, and can become a life safety hazard. It is recommended that maintenance and facility staff verify that the tops of the shelving units are braced or anchored to the nearest backing wall or provide overturning base restraint. Heavy items weighing more than 20 pounds on upper shelves or cabinet furniture should also be restrained by netting or cabling to avoid becoming falling hazards to students or faculty below.

4.4.2 Mechanical Systems

The main seismic concerns for mechanical equipment are sliding, swinging, and overturning. Inadequate lateral restraint or anchorage can shift equipment off its supports, topple equipment to the ground, or dislodge overhead equipment, making them falling hazards. Investigation of above-ceiling mechanical and electrical equipment and systems was not part of this study, but an initial investigation for the presence of mechanical and electrical equipment bracing can be performed by maintenance and facility staff to see if equipment weighing more than 20 pounds with a center of mass more than 4 feet above the adjacent floor level is laterally braced. If bracing is not present, and the equipment poses a falling hazard to students and faculty below, further investigation is recommended by a structural engineer.

4.5 Opinion of Probable Conceptual Seismic Upgrades Costs

An opinion of probable project costs of the concept-level seismic upgrade recommendations provided in this report is included in Appendix C. The input of the scope of work to develop the probable costs is the Tier 1 checklists and the preliminary concept-level seismic upgrades design recommendations and sketches. These preliminary concept-level design sketches depict a design concept that could be implemented to improve the seismic safety of the building structure. It is important to note the preliminary seismic upgrades design concept is based on the results of the Tier 1 seismic screening checklists and engineering design judgement and has not been substantiated by detailed structural analyses and calculations.

For this preliminary opinion of probable costs the estimate of construction costs of the preliminary scope of work is developed based on current 1st Quarter (1Q) 2021 costs. Costs are then escalated to 4Q 2022 at 6% per year of the baseline cost estimate. Costs are developed based on the Tier 1 checklist, concept-level seismic upgrade design sketches, and project narratives.

A range of the cost estimate of -20% (low) to +50% (high) is used to develop the range of the construction cost estimate for the concept-level scope of work. The -20% to +50% range guidance is from Table 1 of the AACE International Recommended Practice 56R-08, *Cost Estimate Classification System*. This estimate is classified as a Class 5 based on the level of design of 0% to 2%. The range of a Class 5 construction cost estimate based on the AACE guidance selected for this estimate is a -20% to +50%.

The estimated total cost (construction costs plus soft costs) to mitigate the deficiencies identified in the Tier 1 checklists of the Burlington-Edison High School Gym/Fieldhouse Building ranges between approximately \$5.0M and \$9.37M (-20%/+50%). The baseline estimated total cost to seismically upgrade this building is approximately \$6.25M. On a per-square-foot basis, the baseline seismic upgrade cost is estimated to be approximately \$125 per square foot in 4Q 2022 dollars, with a range between \$100 per square foot and \$187 per square foot. Note however that this estimated cost and cost range could be significantly higher if the presence of liquefiable soils is discovered and requires ground improvements on the Burlington-Edison High School campus to mitigate post-earthquake liquefaction settlement. A detailed geotechnical investigation is also recommended prior to doing a seismic upgrade design project.

4.5.1 Opinion of Probable Construction Costs

This conceptual opinion of construction cost includes labor, materials, equipment, and scope contingency, general contractor general conditions, home office overhead, and profit. This is based on a public sector design-bid-build project delivery method. Project delivery methods such as negotiated, state of Washington GC/CM, and design-build are not the basis of the construction costs. Owner's soft costs are described below in Section 4.5.2.

The cost is developed in 1Q 2021 costs. The costs are then escalated to 4Q 2022 using an escalation rate of 6.0% per year. If the mid-point of construction will occur at a date earlier or later than 4Q 2022, then it is appropriate to adjust the escalation to the revised mid-point of construction. Construction costs excluded from the estimate are site work, phasing of

construction, additional building modifications not directly related to the seismic scope of work, off hours labor costs, accelerated schedule overtime labor costs, replacement/relocation/additional FF+E, and building code changes that occur after this report.

For project budget planning purposes, it is highly recommended that the opinion of probable project costs is determined including: the overall construction budget of the seismic upgrade and additional scope of work for the building via the services of an A/E design team to study the proposed seismic mitigation strategies to refine the concept-level seismic upgrades design approach contained in this report, determine the construction timeline to adjust the escalation costs, define the construction phasing, if any, and the project soft costs.

4.5.2 Opinion of Probable A-E Design Budgets and Owner's Additional Project Costs (Soft Costs)

Additional owner's project costs would likely include owner's project administration costs, including project management, financing/bond costs, administration/contract/accounting costs, review of plans, value engineering studies, building permits, bidding costs, equipment, fixtures, furnishings and technology, and relocation of the school staff and students during construction. These costs are known as soft costs.

These soft costs have been included in the opinion of probable costs at 40% of the baseline probable construction cost for the seismic upgrade of this building.

The soft costs used for the projects that total to 40% are:

A+E Design - 10%

QA/QC Testing - 2%

Project Administration - 2%

Owner Contingency - 11%

Average Washington State Sales Tax - 9%

Building Permits - 6%

It is typical for soft costs to vary from owner to owner. Based upon our team members' experience on K-12 school projects in the state of Washington, it is our opinion that an allowance of 40% of the average probable construction cost is a reasonable and appropriate soft cost recommendation for planning purposes. We also recommend that each owner develop their own soft costs as part of their budgeting process and not rely solely on this recommended percentage.

4.5.3 Escalation Rate

A 6.0%/year construction cost escalation rate is used for planning purposes for the conceptual estimates. The rate is compounded annually to the projected midpoint of construction. This rate is representative of the escalation based on the previous five years of market experience of construction costs throughout the state of Washington and is projected going forward for these projects. This rate is calculated to the 4th Quarter of 2022 as an allowance for planning purposes. The actual construction schedule for the project is to be determined, and we recommend the escalation cost be revised based on revised construction schedule using the 6%/year rate.

Table 4.5.3-1. Seismic Upgrades Opinion of Probable Construction Costs.

Building	FEMA Bldg Type	ASCE 41 Level of Seismicity / Site Class	Structural Performance Objective	Bldg Gross Area	Estimated Construction Cost Range \$/SF (Total)	Estimated Construction Cost/SF (Total)
Burlington-Edison High School Main Bldg	RM1	High / D	Structural			
			Life Safety	50,133	\$55 - \$103 (\$2.75M) (\$5.15M)	\$69 (\$3.43M)
			Nonstructural			
			Life Safety	50,133	\$16 - \$31 (\$824K) (\$1.54M)	\$20 (\$1.03M)
			Total			
				50,133	\$71 - \$134 (\$3.57M) (\$6.69M)	\$89 (\$4.46M)
Estimated Soft Costs:						\$1.79M
Total Estimated Project Costs:						\$6.25M

W: Wood-Framed; URM: Unreinforced Masonry; RM: Reinforced Masonry; C: Reinforced Concrete; PC: Precast concrete; S: Steel-framed

Appendix A: ASCE 41 Tier 1 Screening Report

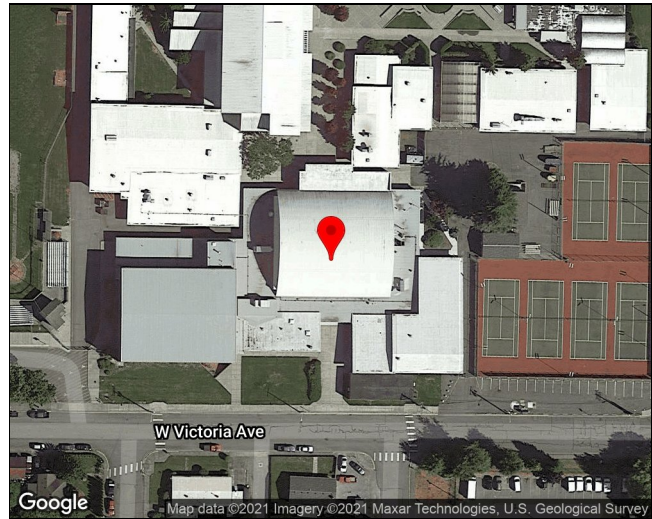
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1. Burlington-Edison, Burlington-Edison High School, Fieldhouse 1953 and 1975

1.1 Building Description

Building Name:	Fieldhouse 1953 and 1975
Facility Name:	Burlington-Edison High School
District Name:	Burlington-Edison
ICOS Latitude:	48.478157
ICOS Longitude:	-122.337203
ICOS Building ID:	50109
ASCE 41 Bldg Type:	RM1
Enrollment:	1082
Gross Sq. Ft. :	36097
Year Built:	1953
Number of Stories:	1
S _{XS} BSE-2E:	0.931
S _{X1} BSE-2E:	0.567
ASCE 41 Level of Seismicity:	High
Site Class:	D
V _{S30} (m/s):	189
Liquefaction Potential:	moderate to high
Tsunami Risk:	No
Structural Drawings Available:	Partial
Evaluating Firm:	Reid Middleton, Inc.

** Liquefaction Potential and Tsunami Risk is based on publicly available state geologic hazard mapping.*



The Fieldhouse at Burlington-Edison High School is a single-story, 36,097 square foot building that houses a gymnasium, wrestling room, locker rooms, weight lifting room and some classroom space. A second gymnasium is located in a 1984 building addition that has its own seismic evaluation. The building footprint is approximately 300 feet by 180 feet. Building framing in the original 1953 gym consists of CMU and Concrete perimeter walls with a steel and wood roof. The building framing in the 1973 addition consists of reinforced brick masonry walls and wood and steel roof framing.

1.1.1 Building Use

The Fieldhouse contains a gym and physical education spaces, as well as a band room. A second gym is located in a 1984 building addition.

1.1.2 Structural System

Table 1-1. Structural System Description of Burlington-Edison High School

Structural System	Description
Structural Roof	The roof framing over the 1953 gym consists of 1-inch diagonal wood sheathing over 2x12 wood joists spanning between arched glulam beams members and concrete walls. The roof at the northeast corner consists of concrete slabs and beams spanning between concrete walls. The remaining roof framing around the gym consists of 1-inch diagonal sheathing over 2x12 wood joists spanning between steel beams, concrete walls and CMU walls.
	The roof framing over the 1973 addition consists of 2x6 tongue and groove decking over glulam beams supported by steel columns and CMU walls.
Structural Floor(s)	The floor framing at the 1953 gym consists of 1-inch diagonal wood sheathing over 2x10 wood joists spanning between wood beams supported on concrete plinths over pile caps. A crawl space exists underneath the gymnasium floor. The remaining floor framing around the gym consists of concrete slabs spanning over concrete beams supported by concrete plinths over pile caps.
	The floor at the 1973 addition consists of a concrete slab on grade.
Foundations	The foundation of the 1953 gym consists of wood piles tied together with concrete grade beams and pile caps.
	The foundation of the 1973 addition consists of continuous footings under the masonry walls and pad footings below the steel columns.
Gravity System	The gravity system in the 1953 gym consists of roof framing supported by concrete and masonry walls, and concrete plinths.
	The gravity system of the 1973 addition consists of roof framing supported by masonry walls and steel columns.
Lateral System	The lateral system of the 1953 gym consists a roof diaphragm and perimeter concrete and masonry shear walls.
	The lateral system of the 1973 addition consists of a roof diaphragm and perimeter masonry walls.

1.1.3 Structural System Visual Condition

Table 1-2. Structural System Condition Description of Burlington-Edison High School

Structural System	Description
Structural Roof	No visible deterioration or damage was observed.

Structural Floor(s)	No visible deterioration or damage was observed.
Foundations	No visible deterioration or damage was observed. The below-grade foundations were not visible.
Gravity System	No visible deterioration or damage was observed.
Lateral System	No visible deterioration or damage was observed.



Figure 1-1. Fieldhouse, Northwest Corner



Figure 1-2. Fieldhouse, Northeast Corner.



Figure 1-3. Fieldhouse, Southeast Corner.



Figure 1-4. Fieldhouse, South Elevation.



Figure 1-5. Fieldhouse, 1953 Gym



Figure 1-6. Fieldhouse, Arched Glulam to Wall Connection.



Figure 1-7. Fieldhouse, Weight Room.



Figure 1-8. Fieldhouse, 1973 Addition.



Figure 1-9. Fieldhouse Main Entrance Interior.

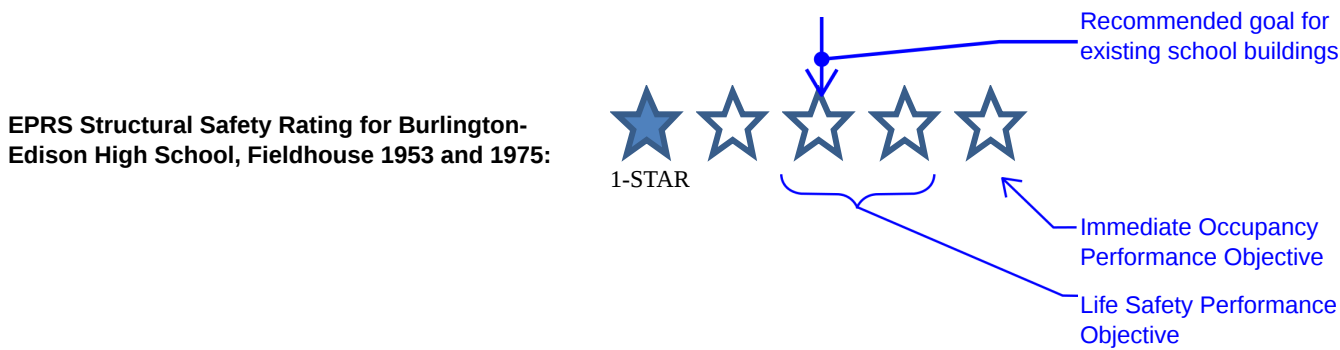


Figure 1-10. Fieldhouse, Weight Room Exterior Wall from Interior.

1.1.4 Earthquake Performance Rating System - Structural Safety Rating

The seismic evaluation items from the ASCE 41 Tier 1 seismic evaluation checklist have been translated to a Structural Safety star-rating using the *EPRS ASCE 41-13 Translation Procedure*. There are two other safety sub-ratings using the *EPRS Translation Procedure*: a Geologic safety sub-rating and a Nonstructural safety sub-rating, that are not included below.

The structural safety star-rating below is a preliminary rating based on the information available for this study. The geologic checklist items have been excluded from the structural safety star-rating. If a building's structural safety star-rating is to be improved, it may also be necessary to further assess the geologic conditions of the building site. Determining the final star-rating of a building is intended to be an iterative process and preliminary ratings will often times be conservative until more field investigation, structural analysis, and engineering judgment is performed by a structural engineer. The intent in providing a preliminary star-rating as part of this study is to provide school districts with the action lists below to further improve the seismic performance and safety of the buildings that were assessed. The tables below indicate the Unknown (U) or Noncompliant (NC) structural seismic evaluation items that should be mitigated or further investigated to improve the Earthquake Performance Rating System (EPRS) structural safety rating for this building.








1-STAR		Risk of Collapse in Multiple or Widespread Locations (Expected performance as a whole would lead to multiple or widespread conditions known to be associated with earthquake-related collapse resulting in injury, entrapment, or death.)
2-STAR		Risk of Collapse in Isolated Locations (Expected performance in certain locations within or adjacent to the building would lead to conditions known to be associated with earthquake-related collapse resulting in injury, entrapment, or death.)
3-STAR		Loss of Life Unlikely (Expected performance results in conditions that are unlikely to cause severe structural damage or loss of life). A 3-star rating meets the Tier 1 Life Safety (LS) structural performance objective.
4-STAR		Serious Injuries Unlikely (Expected performance results in conditions that are associated with limited structural damage and are unlikely to cause serious injuries).
5-STAR		Injuries and Entrapment Unlikely (Expected performance results in conditions that are associated with minimal structural damage and are unlikely to cause injuries or keep people from exiting the building). A 5-star rating meets the Tier 1 Immediate Occupancy (IO) structural performance objective.

Table 1-3. Identified Seismic Evaluation Items to Address for an improved



2-STAR Rating

Evaluation Item	Tier 1 Screening	Description
Wall Anchorage	Noncompliant	The record drawings provided do not show all the details for how the walls are anchored to the diaphragms. Based on the details provided, it is suspected that the wall connections to the diaphragms are not compliant with this checklist item. Increasing the strength of the wall to roof diaphragm connections may be warranted to improve the building's resistance to earthquakes.
Cross Ties	Noncompliant	The 1950s portion of the building and the 1970s portion of the building do not have continuous cross ties in both direction. The addition of cross ties may be warranted to improve building seismic performance.
Spans	Noncompliant	The diaphragm for the 1950s portion of the structure has diagonal 1x sheathing and is compliant. However, the 1970s portion of the structure has a straight sheathing diaphragm and spans longer than 24 feet. The 1970s portion of the structure is noncompliant with this checklist item. Strengthening of the roof diaphragm may be warranted to increase the building seismic strength.
Diagonally Sheathed and Unblocked Diaphragms	Noncompliant	The 1950s portion of the building has diagonally sheathed diaphragm roof and spans much more than the 40 foot limit. The 1970s portion of the building has straight sheathed tongue & groove deck diaphragm and spans further than the 40 foot limit.

Note: All of the evaluation items in Table 3 need to be assessed as Compliant (C) in order to achieve a 2-Star Structural Safety Rating.

Table 1-4. Additional Seismic Evaluation Items to Mitigate or Further Investigate for an improved



3-STAR Rating

Evaluation Item	Tier 1 Evaluation	Description
Ties Between Foundation Elements	Noncompliant	There are ties between the foundation elements in the 1953 gym, however in the remaining structure, there are no ties across the building or slab ties indicated in the record drawings. Soils and liquefaction review should be performed to verify capacity of exterior soils to restrain wall movement. Additional foundation ties may be appropriate to mitigate seismic risk.
Reinforcing Steel	Unknown	Reinforcing information is not shown on the available record drawings for the 1970s portion of the structure. Consequently, the reinforcing steel for this portion of the structure is unknown.

Note: Tables 3 and 4 are cumulative. All of the evaluation items in Table 4 need to be assessed as Compliant (C) in addition to all of the evaluation items in Table 3 being assessed as Compliant (C), in order to achieve a 3-Star Structural Safety Rating.

The Structural Safety star-rating contained in this report is based on ASCE 41 Tier 1 Screening Checklists only. These seismic screening checklists are often the first step employed by structural engineers when trying to determine the seismic vulnerabilities of existing buildings and to begin a process of mitigating these seismic vulnerabilities. School district facilities management personnel and their design consultants should be able to take advantage of this information to help inform and address seismic risks in existing or future renovation, repair, or modernization projects.

It is important to note that information used for these school seismic screenings was limited to available construction drawings and limited site observations by our team of licensed structural engineers. In some cases, construction drawings were not available for review. Due to the limited scope of the study, our team of engineers were not able to perform more-detailed investigations above ceilings, behind wall finishes, in confined spaces, or in other areas obstructed from view. In many cases, further investigation and engineering analysis may find that items marked as unknown or noncompliant may not require seismic mitigation if it is shown that the existing structure is acceptable in its current state. In these cases, further investigation and engineering analysis should be conducted ahead of a seismic upgrade construction project, especially when a building is marked as having many unknown items.

1.2 Seismic Evaluation Findings

1.2.1 Structural Seismic Deficiencies

The structural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation.

Table 1-5. Identified Structural Seismic Deficiencies for Burlington-Edison Burlington-Edison High School Fieldhouse 1953 and 1975

Deficiency	Description
Ties Between Foundation Elements	There are ties between the foundation elements in the 1953 gym, however in the remaining structure, there are no ties across the building or slab ties indicated in the record drawings. Soils and liquefaction review should be performed to verify capacity of exterior soils to restrain wall movement. Additional foundation ties may be appropriate to mitigate seismic risk.
Wall Anchorage	The record drawings provided do not show all the details for how the walls are anchored to the diaphragms. Based on the details provided, it is suspected that the wall connections to the diaphragms are not compliant with this checklist item. Increasing the strength of the wall to roof diaphragm connections may be warranted to improve the building's resistance to earthquakes.
Cross Ties	The 1950s portion of the building and the 1970s portion of the building do not have continuous cross ties in both direction. The addition of cross ties may be warranted to improve building seismic performance.
Spans	The diaphragm for the 1950s portion of the structure has diagonal 1x sheathing and is compliant. However, the 1970s portion of the structure has a straight sheathing diaphragm and spans longer than 24 feet. The 1970s portion of the structure is noncompliant with this checklist item. Strengthening of the roof diaphragm may be warranted to increase the building seismic strength.
Diagonally Sheathed and Unblocked Diaphragms	The 1950s portion of the building has diagonally sheathed diaphragm roof and spans much more than the 40 foot limit. The 1970s portion of the building has straight sheathed tongue & groove deck diaphragm and spans further than the 40 foot limit.

1.2.2 Structural Checklist Items Marked as Unknown

Where building structural component seismic adequacy was unknown due to lack of available information or limited observation, the structural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown structural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

Table 1-6. Identified Structural Checklist Items Marked as Unknown for Burlington-Edison Burlington-Edison High School Fieldhouse 1953 and 1975

Unknown Item	Description
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. Moderate to high liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure. The structure appears to be located on a relatively flat site.
Surface Fault Rupture	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.
Reinforcing Steel	Reinforcing information is not shown on the available record drawings for the 1970s portion of the structure. Consequently, the reinforcing steel for this portion of the structure is unknown.

1.3.1 Nonstructural Seismic Deficiencies

The nonstructural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation. Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 1-7. Identified Nonstructural Seismic Deficiencies for Burlington-Edison Burlington-Edison High School Fieldhouse 1953 and 1975

Deficiency	Description
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	It did not appear that contents taller than 6 feet were adequately restrained. Restraining contents by bracing top of contents to nearest backing wall or providing overturning base restraint may be appropriate to mitigate seismic risk.
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	A number of shelving units appear to support heavy items that do not appear well secured. Heavy items on upper shelves should be restrained by netting or cabling to mitigate seismic risk.

1.3.2 Nonstructural Checklist Items Marked as Unknown

Where building nonstructural component seismic adequacy was unknown due to lack of available information or limited observation, the nonstructural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown nonstructural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 1-8. Identified Nonstructural Checklist Items Marked as Unknown for Burlington-Edison Burlington-Edison High School Fieldhouse 1953 and 1975

Unknown Item	Description
LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Emergency power systems were not verified with maintenance or facility staff. Facility staff should verify the use of backup power to control Life Safety systems. If used, further investigation should be performed to determine if seismic anchorage is adequate.
HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	The building has natural gas piping. However, the details of how the piping is anchored are not known. Further investigation should be performed to determine if the natural gas piping is seismically adequate.
HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	It is unknown whether shutoff valves exist. If they do not exist, installation of shutoff valves may be appropriate to reduce seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	It is unknown whether natural gas piping has flexible couplings. If they do not exist, installation of flexible couplings may be appropriate to reduce seismic risk.
HM-6 Piping or Ducts Crossing Seismic Joints. HR-MH; LS-MH; PR-MH.	
MC-1 URM Chimneys. HR-LMH; LS-LMH; PR-LMH.	A large brick masonry chimney exists on the east side of the building. It is not known whether the chimney is reinforced. Further investigation is recommended if it is desired to determine compliance or noncompliance.
MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.	The anchorage of the masonry chimney is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	The types of large equipment and the manner in which that equipment is braced is unknown. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	The types and locations of in-line equipment (if any) and their bracing is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	The manner in which tall narrow equipment is braced is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.

Burlington-Edison, Burlington-Edison High School, Fieldhouse 1953 and 1975

17-2 Collapse Prevention Basic Configuration Checklist

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

Low Seismicity

Building System - General

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Load Path	The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Tier 2: Sec. 5.4.1.1; Commentary: Sec. A.2.1.10)	X				
Adjacent Buildings	The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity. (Tier 2: Sec. 5.4.1.2; Commentary: Sec. A.2.1.2)	X				
Mezzanines	Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Tier 2: Sec. 5.4.1.3; Commentary: Sec. A.2.1.3)			X		

Building System - Building Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Weak Story	The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Tier 2: Sec. 5.4.2.1; Commentary: Sec. A.2.2.2)	X				
Soft Story	The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Tier 2: Sec. 5.4.2.2; Commentary: Sec. A.2.2.3)	X				
Vertical Irregularities	All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Tier 2: Sec. 5.4.2.3; Commentary: Sec. A.2.2.4)	X				

Geometry	There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 5.4.2.4; Commentary: Sec. A.2.2.5)			X		
Mass	There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 5.4.2.5; Commentary: Sec. A.2.2.6)			X		
Torsion	The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Tier 2: Sec. 5.4.2.6; Commentary: Sec. A.2.2.7)	X				The building has flexible diaphragms, which typically are not stiff enough to develop torsional effects. In addition, the location of each of the building's wings center of mass appears to be well-distributed in relation to the resisting element locations.

Moderate Seismicity (Complete the Following Items in Addition to the Items for Low Seismicity)

Geologic Site Hazards

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Liquefaction	Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.1)				X	The liquefaction potential of site soils is unknown at this time given available information. Moderate to high liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.2)				X	Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure. The structure appears to be located on a relatively flat site.
Surface Fault Rupture	Surface fault rupture and surface displacement at the building site are not anticipated. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.3)				X	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.

High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

Foundation Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Overturning	The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (Tier 2: Sec. 5.4.3.3; Commentary: Sec. A.6.2.1)	X				The building's different wings are generally single-story and have larger plan aspect ratios. Global overturning issues are not expected.
Ties Between Foundation Elements	The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Tier 2: Sec. 5.4.3.4; Commentary: Sec. A.6.2.2)		X			There are ties between the foundation elements in the 1953 gym, however in the remaining structure, there are no ties across the building or slab ties indicated in the record drawings. Soils and liquefaction review should be performed to verify capacity of exterior soils to restrain wall movement. Additional foundation ties may be appropriate to mitigate seismic risk.

17-34 Collapse Prevention Structural Checklist for Building Types RM1 and RM2

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

Low and Moderate Seismicity

Seismic-Force-Resisting System

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Redundancy	The number of lines of shear walls in each principal direction is greater than or equal to 2. (Tier 2: Sec. 5.5.1.1; Commentary: Sec. A.3.2.1.1)	X				
Shear Stress Check	The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 70 lb/in.2 (0.48 MPa). (Tier 2: Sec. 5.5.3.1.1; Commentary: Sec. A.3.2.4.1)	X				Reinforcement information for the 1970s addition are not provided on the available record drawings, however, there are not many large openings in the exterior shear walls of that portion of the building. Consequently, it is presumed that the in-plane shear stress in these walls are also less than 70 psi.
Reinforcing Steel	The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in. (1220 mm), and all vertical bars extend to the top of the walls. (Tier 2: Sec. 5.5.3.1.3; Commentary: Sec. A.3.2.4.2)				X	Reinforcing information is not shown on the available record drawings for the 1970s portion of the structure. Consequently, the reinforcing steel for this portion of the structure is unknown.

Stiff Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Topping Slab	Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (Tier 2: Sec. 5.6.4; Commentary: Sec. A.4.5.1)			X		The building has flexible diaphragms.

Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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Wall Anchorage	Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. (Tier 2: Sec. 5.7.1.1; Commentary: Sec. A.5.1.1)		X			The record drawings provided do not show all the details for how the walls are anchored to the diaphragms. Based on the details provided, it is suspected that the wall connections to the diaphragms are not compliant with this checklist item. Increasing the strength of the wall to roof diaphragm connections may be warranted to improve the building's resistance to earthquakes.
Wood Ledgers	The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 5.7.1.3; Commentary: Sec. A.5.1.2)	X				
Transfer to Shear Walls	Diaphragms are connected for transfer of seismic forces to the shear walls. (Tier 2: Sec. 5.7.2; Commentary: Sec. A.5.2.1)	X				
Topping Slab to Walls or Frames	Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (Tier 2: Sec. 5.7.2; Commentary: Sec. A.5.2.)			X		
Foundation Dowels	Wall reinforcement is doweled into the foundation. (Tier 2: Sec. 5.7.3.4; Commentary: Sec. A.5.3.5)	X				
Girder-Column Connection	There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 5.7.4.1; Commentary: Sec. A.5.4.1)	X				The beam connection details for the 1970s portion of the building are not shown on the record drawings. However, it is suspected that there is positive connection hardware connecting the beams to their column support.

High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

Stiff Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Openings at Shear Walls	Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.4)			X		The building has flexible diaphragms.

Openings at Exterior Masonry Shear Walls	Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.6)			X		
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Flexible Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Cross Ties	There are continuous cross ties between diaphragm chords. (Tier 2: Sec. 5.6.1.2; Commentary: Sec. A.4.1.2)		X			The 1950s portion of the building and the 1970s portion of the building do not have continuous cross ties in both direction. The addition of cross ties may be warranted to improve building seismic performance.
Openings at Shear Walls	Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.4)			X		
Openings at Exterior Masonry Shear Walls	Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.6)			X		
Straight Sheathing	All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.1)	X				The 1970s portion of the structure has a straight-sheathed diaphragm. The diaphragm is "L" shaped in plan. The aspect ratio of each subdiaphragm of the "L" shape has aspect ratios less than 2-to-1 and are compliant with this checklist item.
Spans	All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.2)		X			The diaphragm for the 1950s portion of the structure has diagonal 1x sheathing and is compliant. However, the 1970s portion of the structure has a straight sheathing diaphragm and spans longer than 24 feet. The 1970s portion of the structure is noncompliant with this checklist item. Strengthening of the roof diaphragm may be warranted to increase the building seismic strength.

Diagonally Sheathed and Unblocked Diaphragms	All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4 to-1. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.3)		X			The 1950s portion of the building has diagonally sheathed diaphragm roof and spans much more than the 40 foot limit. The 1970s portion of the building has straight sheathed tongue & groove deck diaphragm and spans further than the 40 foot limit.
Other Diaphragms	Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 5.6.5; Commentary: Sec. A.4.7.1)	X				

Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Stiffness of Wall Anchors	Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. (3 mm) before engagement of the anchors. (Tier 2: Sec. 5.7.1.2; Commentary: Sec. A.5.1.4)	X				Anchors, where they exist, appear to be stiff enough to engage without slipping a significant amount.

Burlington-Edison, Burlington-Edison High School, Fieldhouse 1953 and 1975

17-38 Nonstructural Checklist

Notes:

C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Performance Level: HR = Hazards Reduced, LS = Life Safety, and PR = Position Retention.

Level of Seismicity: L = Low, M = Moderate, and H = High

Life Safety Systems

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping is anchored and braced in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.1)			X		The building does not have a fire suppression system.
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping has flexible couplings in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.2)			X		The building does not have a fire suppression system.
LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Equipment used to power or control Life Safety systems is anchored or braced. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.1)				X	Emergency power systems were not verified with maintenance or facility staff. Facility staff should verify the use of backup power to control Life Safety systems. If used, further investigation should be performed to determine if seismic anchorage is adequate.
LSS-4 Stair and Smoke Ducts. HR-not required; LS-LMH; PR-LMH.	Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.1)			X		The building is a single-story structure.
LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.3)			X		The building does not have a fire suppression system.
LSS-6 Emergency Lighting. HR-not required; LS-not required; PR-LMH	Emergency and egress lighting equipment is anchored or braced. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.1)			X		

Hazardous Materials

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
HM-1 Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH.	Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.2)			X		

HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 13.8.3; Commentary: Sec. A.7.15.1)			X		Breakable containers with hazardous contents were not observed.
HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)				X	The building has natural gas piping. However, the details of how the piping is anchored are not known. Further investigation should be performed to determine if the natural gas piping is seismically adequate.
HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	Piping containing hazardous material, including natural gas, has shutoff valves or other devices to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.3)				X	It is unknown whether shutoff valves exist. If they do not exist, installation of shutoff valves may be appropriate to reduce seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	Hazardous material ductwork and piping, including natural gas piping, have flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.15.4)				X	It is unknown whether natural gas piping has flexible couplings. If they do not exist, installation of flexible couplings may be appropriate to reduce seismic risk.
HM-6 Piping or Ducts Crossing Seismic Joints. HR-MH; LS-MH; PR-MH.	Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.3, 13.7.5, 13.7.6; Commentary: Sec. A.7.13.6)				X	The building does not have explicit seismic joints, but the building does have different wings built at different times. It is not known if natural gas piping crosses between different wings of the building. Further investigation of the natural gas piping is recommended.

Partitions

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
P-1 Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft (3.0 m) in Low or Moderate Seismicity, or at most 6 ft (1.8 m) in High Seismicity. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.1)			X		

P-2 Heavy Partitions Supported by Ceilings. HR-LMH; LS-LMH; PR-LMH.	The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)			X		
P-3 Drift. HR-not required; LS-MH; PR-MH.	Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.2)			X		
P-4 Light Partitions Supported by Ceilings. HR-not required; LS-not required; PR-MH.	The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)			X		
P-5 Structural Separations. HR-not required; LS-not required; PR-MH.	Partitions that cross structural separations have seismic or control joints. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.3)			X		
P-6 Tops. HR-not required; LS-not required; PR-MH.	The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft (1.8 m). (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.4)			X		

Ceilings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
C-1 Suspended Lath and Plaster. HR-H; LS-MH; PR-LMH.	Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft ² (1.1 m ²) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		
C-2 Suspended Gypsum Board. HR-not required; LS-MH; PR-LMH.	Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft ² (1.1 m ²) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		
C-3 Integrated Ceilings. HR-not required; LS-not required; PR-MH.	Integrated suspended ceilings with continuous areas greater than 144 ft ² (13.4 m ²) and ceilings of smaller areas that are not surrounded by restraining partitions are laterally restrained at a spacing no greater than 12 ft (3.6 m) with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.2)			X		Not required for life safety performance level.

C-4 Edge Clearance. HR-not required; LS-not required; PR-MH.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft ² (13.4 m ²) have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in. (13 mm); in High Seismicity, 3/4 in. (19 mm). (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.4)			X		Not required for life safety performance level.
C-5 Continuity Across Structure Joints. HR-not required; LS-not required; PR-MH.	The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.5)			X		Not required for life safety performance level.
C-6 Edge Support. HR-not required; LS-not required; PR-H.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft ² (13.4 m ²) are supported by closure angles or channels not less than 2 in. (51 mm) wide. (Tier 2: Sec. 13.6.4 ; Commentary: Sec. A.7.2.6)			X		Not required for life safety performance level.
C-7 Seismic Joints. HR-not required; LS-not required; PR-H.	Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2,500 ft ² (232.3 m ²) and has a ratio of long-to-short dimension no more than 4-to-1. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.7)			X		Not required for life safety performance level.

Light Fixtures

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (Tier 2: Sec. 13.6.4, 13.7.9; Commentary: Sec. A.7.3.2)	X				Light fixtures appear to have independent wire supports and, or do not penetrate ceilings or are heavier than the ceilings they penetrate.
LF-2 Pendant Supports. HR-not required; LS-not required; PR-H.	Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft. Unbraced suspended fixtures are free to allow a 360-degree range of motion at an angle not less than 45 degrees from horizontal without contacting adjacent components. Alternatively, if rigidly supported and/or braced, they are free to move with the structure to which they are attached without damaging adjoining components. Additionally, the connection to the structure is capable of accommodating the movement without failure. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.3)			X		Not required for life safety performance level.
LF-3 Lens Covers. HR-not required; LS-not required; PR-H.	Lens covers on light fixtures are attached with safety devices. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.4)			X		Not required for life safety performance level.

Cladding and Glazing

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CG-1 Cladding Anchors. HR-MH; LS-MH; PR-MH.	Cladding components weighing more than 10 lb/ft ² (0.48 kN/m ²) are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft (1.8 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft (1.2 m) (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.1)			X		The building does not have cladding panels.
CG-2 Cladding Isolation. HR-not required; LS-MH; PR-MH.	For steel or concrete moment-frame buildings, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.3)			X		
CG-3 Multi-Story Panels. HR-MH; LS-MH; PR-MH.	For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.4)			X		
CG-4 Threaded Rods. HR-not required; LS-MH; PR-MH.	Threaded rods for panel connections detailed to accommodate drift by bending of the rod have a length-to-diameter ratio greater than 0.06 times the story height in inches for Life Safety in Moderate Seismicity and 0.12 times the story height in inches for Life Safety in High Seismicity and Position Retention in any seismicity. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.9)			X		
CG-5 Panel Connections. HR-MH; LS-MH; PR-MH.	Cladding panels are anchored out of plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.5)			X		

CG-6 Bearing Connections. HR-MH; LS-MH; PR-MH.	Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.6)			X		
CG-7 Inserts. HR-MH; LS-MH; PR-MH.	Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.7)			X		
CG-8 Overhead Glazing. HR-not required; LS-MH; PR-MH.	Glazing panes of any size in curtain walls and individual interior or exterior panes more than 16 ft ² (1.5 m ²) in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (Tier 2: Sec. 13.6.1.5; Commentary: Sec. A.7.4.8)			X		

Masonry Veneer

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
M-1 Ties. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft ² (0.25 m ²), and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in. (914 mm); for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (610 mm). (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.1)			X		The building exterior is structural masonry, not masonry veneer.
M-2 Shelf Angles. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.2)			X		
M-3 Weakened Planes. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.3)			X		
M-4 Unreinforced Masonry Backup. HR-LMH; LS-LMH; PR-LMH.	There is no unreinforced masonry backup. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.2)			X		
M-5 Stud Tracks. HR-not required; LS-MH; PR-MH.	For veneer with coldformed steel stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. (610 mm) on center. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.)			X		
M-6 Anchorage. HR-not required; LS-MH; PR-MH.	For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.1)			X		

M-7 Weep Holes. HR-not required; LS-not required; PR-MH.	In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.6)			X		Not required for life safety performance level.
M-8 Openings. HR-not required; LS-not required; PR-MH.	For veneer with cold-formed-steel stud backup, steel studs frame window and door openings. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.2)			X		Not required for life safety performance level.

Parapets, Cornices, Ornamentation, and Appendages

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PCOA-1 URM Parapets or Cornices. HR-LMH; LS-LMH; PR-LMH.	Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.1)			X		The building does not have URM parapets.
PCOA-2 Canopies. HR-not required; LS-LMH; PR-LMH.	Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft (3.0 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft (1.8 m). (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.2)	X				
PCOA-3 Concrete Parapets. HR-H; LS-MH; PR-LMH.	Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.3)			X		The building does not have concrete parapets.
PCOA-4 Appendages. HR-MH; LS-MH; PR-LMH.	Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft (1.8 m). This evaluation statement item does not apply to parapets or cornices covered by other evaluation statements. (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.4)			X		

Masonry Chimneys

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
MC-1 URM Chimneys. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.1)				X	A large brick masonry chimney exists on the east side of the building. It is not known whether the chimney is reinforced. Further investigation is recommended if it is desired to determine compliance or noncompliance.

MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.	Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.2)				X	The anchorage of the masonry chimney is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.
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Stairs

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
S-1 Stair Enclosures. HR-not required; LS-LMH; PR-LMH.	Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out of plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (Tier 2: Sec. 13.6.2, 13.6.8; Commentary: Sec. A.7.10.1)			X		
S-2 Stair Details. HR-not required; LS-LMH; PR-LMH.	The connection between the stairs and the structure does not rely on post-installed anchors in concrete or masonry, and the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.4.3.1 for moment-frame structures or 0.5 in. for all other structures without including any lateral stiffness contribution from the stairs. (Tier 2: Sec. 13.6.8; Commentary: Sec. A.7.10.2)			X		

Contents and Furnishings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CF-1 Industrial Storage Racks. HR-LMH; LS-MH; PR-MH.	Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/RMI MH 16.1 as modified by ASCE 7, Chapter 15. (Tier 2: Sec. 13.8.1; Commentary: Sec. A.7.11.1)			X		
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Contents more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.2)		X			It did not appear that contents taller than 6 feet were adequately restrained. Restraining contents by bracing top of contents to nearest backing wall or providing overturning base restraint may be appropriate to mitigate seismic risk.

CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Equipment, stored items, or other contents weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level are braced or otherwise restrained. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.3)		X			A number of shelving units appear to support heavy items that do not appear well secured. Heavy items on upper shelves should be restrained by netting or cabling to mitigate seismic risk.
CF-4 Access Floors. HR-not required; LS-not required; PR-MH.	Access floors more than 9 in. (229 mm) high are braced. (Tier 2: Sec. 13.6.10; Commentary: Sec. A.7.11.4)			X		Not required for life safety performance level.
CF-5 Equipment on Access Floors. HR-not required; LS-not required; PR-MH.	Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (Tier 2: Sec. 13.7.7 13.6.10; Commentary: Sec. A.7.11.5)			X		Not required for life safety performance level.
CF-6 Suspended Contents. HR-not required; LS-not required; PR-H.	Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.6)			X		Not required for life safety performance level.

Mechanical and Electrical Equipment

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	Equipment weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level, and which is not in-line equipment, is braced. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.4)				X	The types of large equipment and the manner in which that equipment is braced is unknown. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Equipment installed in line with a duct or piping system, with an operating weight more than 75 lb (34.0 kg), is supported and laterally braced independent of the duct or piping system. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.5)				X	The types and locations of in-line equipment (if any) and their bracing is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	Equipment more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.6)				X	The manner in which tall narrow equipment is braced is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.

ME-4 Mechanical Doors. HR-not required; LS-not required; PR-MH.	Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (Tier 2: Sec. 13.6.9; Commentary: Sec. A.7.12.7)			X		Not required for life safety performance level.
ME-5 Suspended Equipment. HR-not required; LS-not required; PR-H.	Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.8)			X		Not required for life safety performance level.
ME-6 Vibration Isolators. HR-not required; LS-not required; PR-H.	Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.9)			X		Not required for life safety performance level.
ME-7 Heavy Equipment. HR-not required; LS-not required; PR-H.	Floor supported or platform-supported equipment weighing more than 400 lb (181.4 kg) is anchored to the structure. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.10)			X		Not required for life safety performance level.
ME-8 Electrical Equipment. HR-not required; LS-not required; PR-H.	Electrical equipment is laterally braced to the structure. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.11)			X		Not required for life safety performance level.
ME-9 Conduit Couplings. HR-not required; LS-not required; PR-H.	Conduit greater than 2.5 in. (64 mm) trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (Tier 2: Sec. 13.7.8; Commentary: Sec. A.7.12.12)			X		Not required for life safety performance level.

Piping

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PP-1 Flexible Couplings. HR-not required; LS-not required; PR-H.	Fluid and gas piping has flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.2)			X		Not required for life safety performance level.
PP-2 Fluid and Gas Piping. HR-not required; LS-not required; PR-H.	Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Not required for life safety performance level.
PP-3 C-Clamps. HR-not required; LS-not required; PR-H.	One-sided C-clamps that support piping larger than 2.5 in. (64 mm) in diameter are restrained. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.5)			X		Not required for life safety performance level.
PP-4 Piping Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.6)			X		Not required for life safety performance level.

Ducts

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
D-1 Duct Bracing. HR-not required; LS-not required; PR-H.	Rectangular ductwork larger than 6 ft ² (0.56 m ²) in cross-sectional area and round ducts larger than 28 in. (711 mm) in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft (9.2 m). The maximum spacing of longitudinal bracing does not exceed 60 ft (18.3 m). (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.2)			X		Not required for life safety performance level.
D-2 Duct Support. HR-not required; LS-not required; PR-H.	Ducts are not supported by piping or electrical conduit. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.3)			X		Not required for life safety performance level.
D-3 Ducts Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.4)			X		Not required for life safety performance level.

Elevators

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
EL-1 Retainer Guards. HR-not required; LS-H; PR-H.	Sheaves and drums have cable retainer guards. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.1)			X		The building does not have an elevator.
EL-2 Retainer Plate. HR-not required; LS-H; PR-H.	A retainer plate is present at the top and bottom of both car and counterweight. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.2)			X		
EL-3 Elevator Equipment. HR-not required; LS-not required; PR-H.	Equipment, piping, and other components that are part of the elevator system are anchored. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.3)			X		Not required for life safety performance level.
EL-4 Seismic Switch. HR-not required; LS-not required; PR-H.	Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.4)			X		Not required for life safety performance level.
EL-5 Shaft Walls. HR-not required; LS-not required; PR-H.	Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.5)			X		Not required for life safety performance level.
EL-6 Counterweight Rails. HR-not required; LS-not required; PR-H.	All counterweight rails and divider beams are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.6)			X		Not required for life safety performance level.

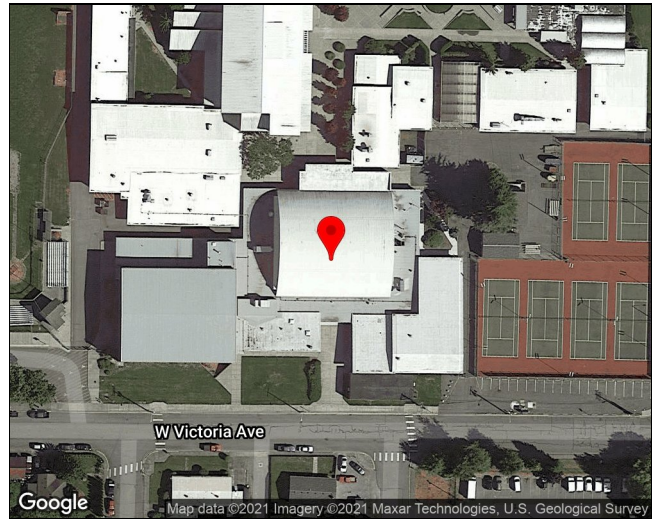
EL-7 Brackets. HR-not required; LS-not required; PR-H.	The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.7)			X		Not required for life safety performance level.
EL-8 Spreader Bracket. HR-not required; LS-not required; PR-H.	Spreader brackets are not used to resist seismic forces. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.8)			X		Not required for life safety performance level.
EL-9 Go-Slow Elevators. HR-not required; LS-not required; PR-H.	The building has a go-slow elevator system. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.9)			X		Not required for life safety performance level.

1. Burlington-Edison, Burlington-Edison High School, Fieldhouse 1984 Addition

1.1 Building Description

Building Name:	Fieldhouse 1984 Addition
Facility Name:	Burlington-Edison High School
District Name:	Burlington-Edison
ICOS Latitude:	48.478157
ICOS Longitude:	-122.337203
ICOS Building ID:	50109
ASCE 41 Bldg Type:	RM1
Enrollment:	1082
Gross Sq. Ft. :	14036
Year Built:	1984
Number of Stories:	1
S _{XS} BSE-2E:	0.931
S _{X1} BSE-2E:	0.567
ASCE 41 Level of Seismicity:	High
Site Class:	D
V _{S30} (m/s):	189
Liquefaction Potential:	moderate to high
Tsunami Risk:	No
Structural Drawings Available:	Partial
Evaluating Firm:	Reid Middleton, Inc.

** Liquefaction Potential and Tsunami Risk is based on publicly available state geologic hazard mapping.*



The Fieldhouse 1984 Addition is a 14,036 square foot addition that houses a gymnasium area, storage area, coach's office, training area and locker rooms. The building is rectangular in plan with approximate dimensions of 116 feet by 121 feet. The building's roof consists of metal deck supported by open web steel joists. The building's walls are reinforced brick masonry. The walls possess relatively few openings as the building does not have windows and there are minimal doorways.

1.1.1 Building Use

The building is an addition that houses a gymnasium area, storage area, coach's office, training area and locker rooms.

1.1.2 Structural System

Table 1-1. Structural System Description of Burlington-Edison High School

Structural System	Description
Structural Roof	The roof framing over the 1984 addition consists of metal deck over open web steel joists spanning between CMU walls. The roof framing at the north side of the addition consists of 1/2-inch plywood sheathing over wood trusses spanning between CMU walls.
Structural Floor(s)	The floor framing at the 1984 addition consists of a concrete slab on grade and an elevated floor deck at the northeast corner consisting of 3/4-inch plywood sheathing over TJI joists spanning between CMU walls.
Foundations	The foundation of the 1984 addition consists of continuous strip footings under the masonry walls.
Gravity System	The gravity system of the 1984 addition consists of metal deck supported by open web steel joists that are supported by reinforced brick masonry bearing walls.
Lateral System	The lateral system of the 1984 addition consists of a metal deck roof diaphragm laterally supported by perimeter reinforced brick masonry walls.

1.1.3 Structural System Visual Condition

Table 1-2. Structural System Condition Description of Burlington-Edison High School

Structural System	Description
Structural Roof	No visible deterioration or damage was observed.
Structural Floor(s)	No visible deterioration or damage was observed.
Foundations	No visible deterioration or damage was observed. The below-grade foundations were not visible.
Gravity System	No visible deterioration or damage was observed.
Lateral System	No visible deterioration or damage was observed.



Figure 1-1. Building Southeast Exterior.



Figure 1-2. Building West Exterior, Looking Southeast.



Figure 1-3. Building West Exterior, Looking Northeast.



Figure 1-4. Building North Exterior, Looking South.



Figure 1-5. Exterior Entrances to Locker Rooms.



Figure 1-6. Building North Exterior, Looking East.



Figure 1-7. Gym Interior.

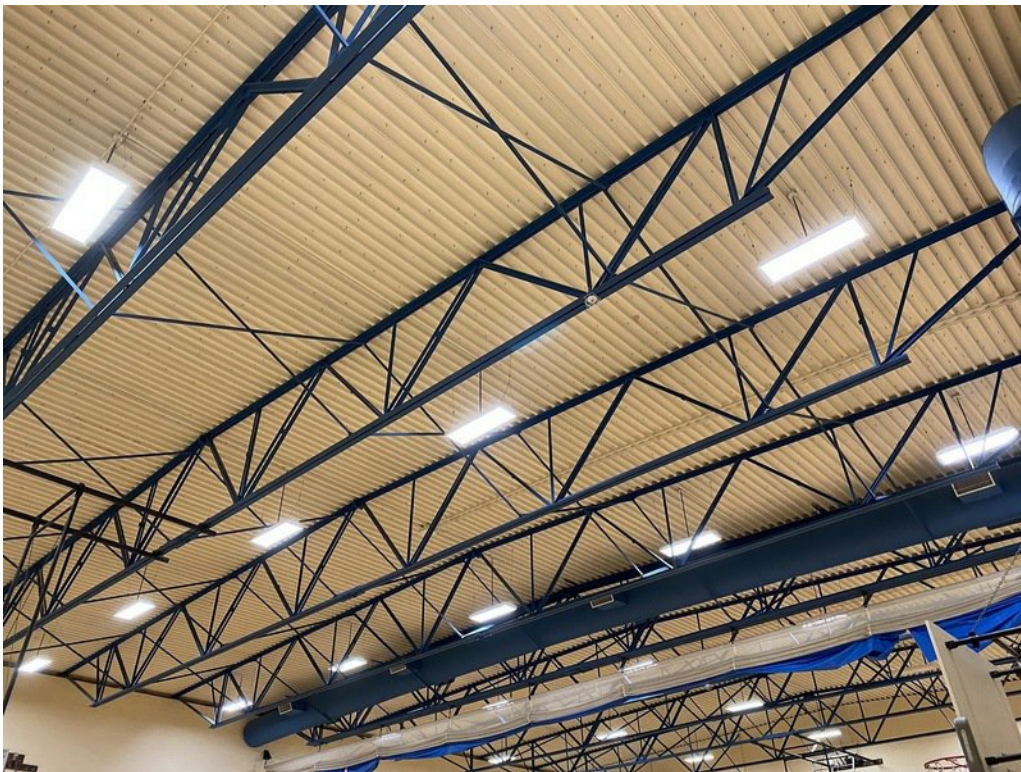


Figure 1-8. Gym Interior Looking at Open Web Steel Joists and Underside of Roof.

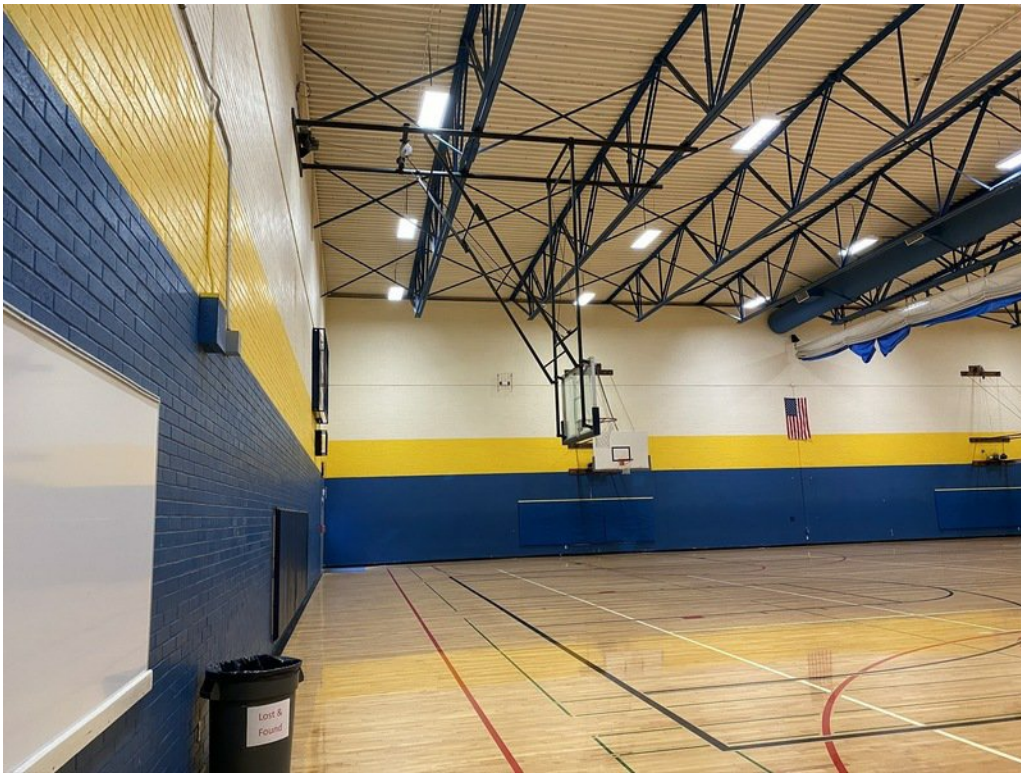


Figure 1-9. Gym Interior Looking Parallel to Open Web Steel Roof Joists.

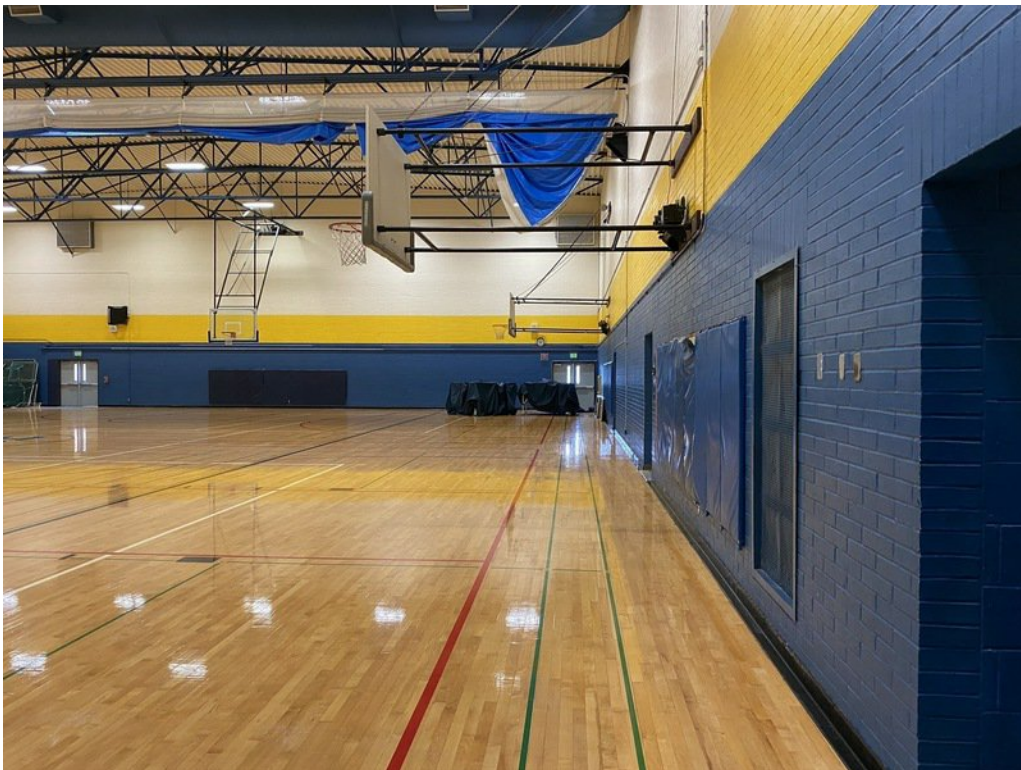
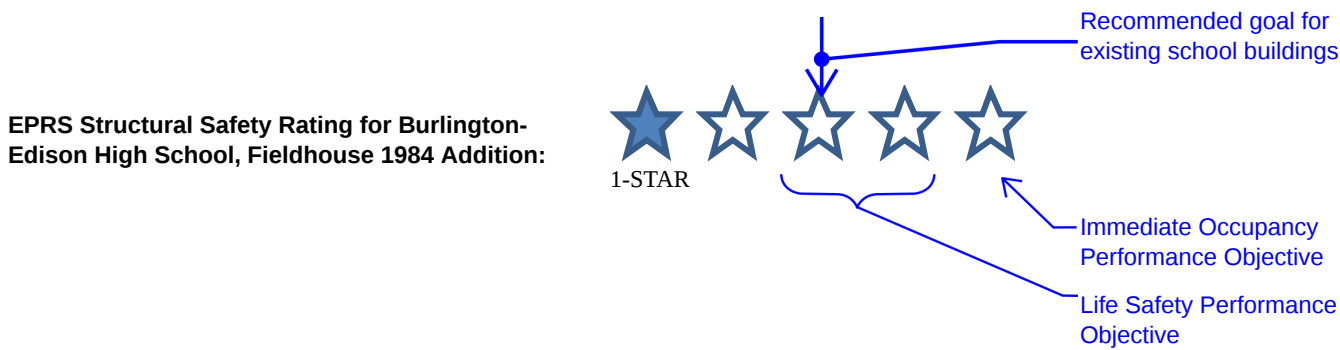


Figure 1-10. Gym Interior with Structural Brick on Right-Hand Side.

1.1.4 Earthquake Performance Rating System - Structural Safety Rating

The seismic evaluation items from the ASCE 41 Tier 1 seismic evaluation checklist have been translated to a Structural Safety star-rating using the *EPRS ASCE 41-13 Translation Procedure*. There are two other safety sub-ratings using the *EPRS Translation Procedure*: a Geologic safety sub-rating and a Nonstructural safety sub-rating, that are not included below.

The structural safety star-rating below is a preliminary rating based on the information available for this study. The geologic checklist items have been excluded from the structural safety star-rating. If a building's structural safety star-rating is to be improved, it may also be necessary to further assess the geologic conditions of the building site. Determining the final star-rating of a building is intended to be an iterative process and preliminary ratings will often times be conservative until more field investigation, structural analysis, and engineering judgment is performed by a structural engineer. The intent in providing a preliminary star-rating as part of this study is to provide school districts with the action lists below to further improve the seismic performance and safety of the buildings that were assessed. The tables below indicate the Unknown (U) or Noncompliant (NC) structural seismic evaluation items that should be mitigated or further investigated to improve the Earthquake Performance Rating System (EPRS) structural safety rating for this building.



1-STAR		Risk of Collapse in Multiple or Widespread Locations (Expected performance as a whole would lead to multiple or widespread conditions known to be associated with earthquake-related collapse resulting in injury, entrapment, or death.)
2-STAR		Risk of Collapse in Isolated Locations (Expected performance in certain locations within or adjacent to the building would lead to conditions known to be associated with earthquake-related collapse resulting in injury, entrapment, or death.)
3-STAR		Loss of Life Unlikely (Expected performance results in conditions that are unlikely to cause severe structural damage or loss of life). A 3-star rating meets the Tier 1 Life Safety (LS) structural performance objective.
4-STAR		Serious Injuries Unlikely (Expected performance results in conditions that are associated with limited structural damage and are unlikely to cause serious injuries).
5-STAR		Injuries and Entrapment Unlikely (Expected performance results in conditions that are associated with minimal structural damage and are unlikely to cause injuries or keep people from exiting the building). A 5-star rating meets the Tier 1 Immediate Occupancy (IO) structural performance objective.

Table 1-3. Identified Seismic Evaluation Items to Address for an improved  **2-STAR Rating**

Evaluation Item	Tier 1 Screening	Description
Wall Anchorage	Noncompliant	The record drawings provided do not show all the details for how the walls are anchored to the diaphragms. Based on the details provided, it is suspected that the wall connections to the diaphragms are not compliant with this checklist item. Increasing the strength of the wall to roof diaphragm connections may be warranted to improve the building's resistance to earthquakes.

Note: All of the evaluation items in Table 3 need to be assessed as Compliant (C) in order to achieve a 2-Star Structural Safety Rating.

Table 1-4. Additional Seismic Evaluation Items to Mitigate or Further Investigate for an improved  **3-STAR Rating**

Evaluation Item	Tier 1 Evaluation	Description
Ties Between Foundation Elements	Noncompliant	The foundations do not have ties spanning between them. Soils and liquefaction review should be performed to verify capacity of exterior soils to restrain wall movement. Additional foundation ties may be appropriate to mitigate seismic risk.

Note: Tables 3 and 4 are cumulative. All of the evaluation items in Table 4 need to be assessed as Compliant (C) in addition to all of the evaluation items in Table 3 being assessed as Compliant (C), in order to achieve a 3-Star Structural Safety Rating.

The Structural Safety star-rating contained in this report is based on ASCE 41 Tier 1 Screening Checklists only. These seismic screening checklists are often the first step employed by structural engineers when trying to determine the seismic vulnerabilities of existing buildings and to begin a process of mitigating these seismic vulnerabilities. School district facilities management personnel and their design consultants should be able to take advantage of this information to help inform and address seismic risks in existing or future renovation, repair, or modernization projects.

It is important to note that information used for these school seismic screenings was limited to available construction drawings and limited site observations by our team of licensed structural engineers. In some cases, construction drawings were not available for review. Due to the limited scope of the study, our team of engineers were not able to perform more-detailed investigations above ceilings, behind wall finishes, in confined spaces, or in other areas obstructed from view. In many cases, further investigation and engineering analysis may find that items marked as unknown or noncompliant may not require seismic mitigation if it is shown that the existing structure is acceptable in its current state. In these cases, further investigation and engineering analysis should be conducted ahead of a seismic upgrade construction project, especially when a building is marked as having many unknown items.

1.2 Seismic Evaluation Findings

1.2.1 Structural Seismic Deficiencies

The structural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation.

Table 1-5. Identified Structural Seismic Deficiencies for Burlington-Edison Burlington-Edison High School Fieldhouse 1984 Addition

Deficiency	Description
Ties Between Foundation Elements	The foundations do not have ties spanning between them. Soils and liquefaction review should be performed to verify capacity of exterior soils to restrain wall movement. Additional foundation ties may be appropriate to mitigate seismic risk.
Wall Anchorage	The record drawings provided do not show all the details for how the walls are anchored to the diaphragms. Based on the details provided, it is suspected that the wall connections to the diaphragms are not compliant with this checklist item. Increasing the strength of the wall to roof diaphragm connections may be warranted to improve the building's resistance to earthquakes.

1.2.2 Structural Checklist Items Marked as Unknown

Where building structural component seismic adequacy was unknown due to lack of available information or limited observation, the structural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown structural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

Table 1-6. Identified Structural Checklist Items Marked as Unknown for Burlington-Edison Burlington-Edison High School Fieldhouse 1984 Addition

Unknown Item	Description
Liquefaction	The liquefaction potential of site soils is unknown at this time given available information. Moderate to high liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure. The structure appears to be located on a relatively flat site.
Surface Fault Rupture	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.

1.3.1 Nonstructural Seismic Deficiencies

The nonstructural seismic deficiencies identified during the Tier 1 evaluation are summarized below. Commentary for each deficiency is also provided based on this evaluation. Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 1-7. Identified Nonstructural Seismic Deficiencies for Burlington-Edison Burlington-Edison High School Fieldhouse 1984 Addition

Deficiency	Description
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1.3.2 Nonstructural Checklist Items Marked as Unknown

Where building nonstructural component seismic adequacy was unknown due to lack of available information or limited observation, the nonstructural checklist items were marked as “unknown”. These items require further investigation if definitive determination of compliance or noncompliance is desired. The unknown nonstructural checklist items identified during the Tier 1 evaluation are summarized below. Commentary for each unknown item is also provided based on the evaluation.

Some nonstructural deficiencies may be able to be mitigated by school district staff. Other nonstructural components that require more substantial mitigation may be more appropriately included in a long-term mitigation strategy. Some typical conceptual details for the seismic upgrade of nonstructural components can be found in the FEMA E-74 Excerpts appendix.

Table 1-8. Identified Nonstructural Checklist Items Marked as Unknown for Burlington-Edison Burlington-Edison High School Fieldhouse 1984 Addition

Unknown Item	Description
LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Emergency power systems were not verified with maintenance or facility staff. Facility staff should verify the use of backup power to control Life Safety systems. If used, further investigation should be performed to determine if seismic anchorage is adequate.
HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	The building has natural gas piping. However, the details of how the piping is anchored are not known. Further investigation should be performed to determine if the natural gas piping is seismically adequate.
HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	It is unknown whether shutoff valves exist. If they do not exist, installation of shutoff valves may be appropriate to reduce seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	It is unknown whether natural gas piping has flexible couplings. If they do not exist, installation of flexible couplings may be appropriate to reduce seismic risk.
HM-6 Piping or Ducts Crossing Seismic Joints. HR-MH; LS-MH; PR-MH.	
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	The types of large equipment and the manner in which that equipment is braced is unknown. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	The types and locations of in-line equipment (if any) and their bracing is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	The manner in which tall narrow equipment is braced is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.

Burlington-Edison, Burlington-Edison High School, Fieldhouse 1984 Addition

17-2 Collapse Prevention Basic Configuration Checklist

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

Low Seismicity

Building System - General

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Load Path	The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Tier 2: Sec. 5.4.1.1; Commentary: Sec. A.2.1.10)	X				
Adjacent Buildings	The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity. (Tier 2: Sec. 5.4.1.2; Commentary: Sec. A.2.1.2)	X				
Mezzanines	Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Tier 2: Sec. 5.4.1.3; Commentary: Sec. A.2.1.3)			X		

Building System - Building Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Weak Story	The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Tier 2: Sec. 5.4.2.1; Commentary: Sec. A.2.2.2)			X		The building is a one-story structure.
Soft Story	The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Tier 2: Sec. 5.4.2.2; Commentary: Sec. A.2.2.3)			X		The building is a one-story structure.
Vertical Irregularities	All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Tier 2: Sec. 5.4.2.3; Commentary: Sec. A.2.2.4)	X				

Geometry	There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 5.4.2.4; Commentary: Sec. A.2.2.5)			X		The building is a one-story structure.
Mass	There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 5.4.2.5; Commentary: Sec. A.2.2.6)			X		The building is a one-story structure.
Torsion	The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Tier 2: Sec. 5.4.2.6; Commentary: Sec. A.2.2.7)	X				The building has a flexible diaphragm, which typically is not stiff enough to develop torsional effects.

Moderate Seismicity (Complete the Following Items in Addition to the Items for Low Seismicity)

Geologic Site Hazards

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Liquefaction	Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.1)				X	The liquefaction potential of site soils is unknown at this time given available information. Moderate to high liquefaction potential is identified per ICOS based on state geologic mapping. Requires further investigation by a licensed geotechnical engineer to determine liquefaction potential.
Slope Failure	The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.2)				X	Requires further investigation by a licensed geotechnical engineer to determine susceptibility to slope failure. The structure appears to be located on a relatively flat site.
Surface Fault Rupture	Surface fault rupture and surface displacement at the building site are not anticipated. (Tier 2: Sec. 5.4.3.1; Commentary: Sec. A.6.1.3)				X	Requires further investigation by a licensed geotechnical engineer to determine whether site is near locations of expected surface fault ruptures.

High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

Foundation Configuration

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Overturning	The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.6Sa. (Tier 2: Sec. 5.4.3.3; Commentary: Sec. A.6.2.1)	X				
Ties Between Foundation Elements	The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Tier 2: Sec. 5.4.3.4; Commentary: Sec. A.6.2.2)		X			The foundations do not have ties spanning between them. Soils and liquefaction review should be performed to verify capacity of exterior soils to restrain wall movement. Additional foundation ties may be appropriate to mitigate seismic risk.

17-34 Collapse Prevention Structural Checklist for Building Types RM1 and RM2

Building record drawings have been reviewed, when available, and a non-destructive field investigation has been performed for the subject building. Each of the required checklist items are marked Compliant (C), Noncompliant (NC), Not Applicable (N/A), or Unknown (U). Items marked Compliant indicate conditions that satisfy the performance objective, whereas items marked Noncompliant or Unknown indicate conditions that do not. Certain statements might not apply to the building being evaluated.

Low and Moderate Seismicity

Seismic-Force-Resisting System

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Redundancy	The number of lines of shear walls in each principal direction is greater than or equal to 2. (Tier 2: Sec. 5.5.1.1; Commentary: Sec. A.3.2.1.1)	X				
Shear Stress Check	The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 70 lb/in.2 (0.48 MPa). (Tier 2: Sec. 5.5.3.1.1; Commentary: Sec. A.3.2.4.1)	X				The 1980s gym addition has relatively few openings in shear walls, and its calculated shear stress is less than 70 psi.
Reinforcing Steel	The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in. (1220 mm), and all vertical bars extend to the top of the walls. (Tier 2: Sec. 5.5.3.1.3; Commentary: Sec. A.3.2.4.2)	X				The reinforcing steel in the 1980s gym addition portion of the building is compliant with the both the vertical and horizontal reinforcing limits.

Stiff Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Topping Slab	Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (Tier 2: Sec. 5.6.4; Commentary: Sec. A.4.5.1)			X		The building has a flexible diaphragm.

Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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Wall Anchorage	Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7. (Tier 2: Sec. 5.7.1.1; Commentary: Sec. A.5.1.1)		X			The record drawings provided do not show all the details for how the walls are anchored to the diaphragms. Based on the details provided, it is suspected that the wall connections to the diaphragms are not compliant with this checklist item. Increasing the strength of the wall to roof diaphragm connections may be warranted to improve the building's resistance to earthquakes.
Wood Ledgers	The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 5.7.1.3; Commentary: Sec. A.5.1.2)	X				
Transfer to Shear Walls	Diaphragms are connected for transfer of seismic forces to the shear walls. (Tier 2: Sec. 5.7.2; Commentary: Sec. A.5.2.1)	X				
Topping Slab to Walls or Frames	Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (Tier 2: Sec. 5.7.2; Commentary: Sec. A.5.2.)			X		
Foundation Dowels	Wall reinforcement is doweled into the foundation. (Tier 2: Sec. 5.7.3.4; Commentary: Sec. A.5.3.5)	X				
Girder-Column Connection	There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 5.7.4.1; Commentary: Sec. A.5.4.1)			X		The building does not have girder-column connections.

High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)

Stiff Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Openings at Shear Walls	Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.4)			X		The building has flexible diaphragms.
Openings at Exterior Masonry Shear Walls	Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.6)			X		

Flexible Diaphragms

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
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Cross Ties	There are continuous cross ties between diaphragm chords. (Tier 2: Sec. 5.6.1.2; Commentary: Sec. A.4.1.2)	X				
Openings at Shear Walls	Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.4)			X		
Openings at Exterior Masonry Shear Walls	Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft (2.4 m) long. (Tier 2: Sec. 5.6.1.3; Commentary: Sec. A.4.1.6)			X		
Straight Sheathing	All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.1)			X		The building has a metal deck diaphragm.
Spans	All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.2)			X		The building has a metal deck diaphragm.
Diagonally Sheathed and Unblocked Diaphragms	All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4 to-1. (Tier 2: Sec. 5.6.2; Commentary: Sec. A.4.2.3)			X		The building has a metal deck diaphragm.
Other Diaphragms	Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 5.6.5; Commentary: Sec. A.4.7.1)	X				

Connections

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
Stiffness of Wall Anchors	Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. (3 mm) before engagement of the anchors. (Tier 2: Sec. 5.7.1.2; Commentary: Sec. A.5.1.4)	X				Anchors, where they exist, appear to be stiff enough to engage without slipping a significant amount.

Burlington-Edison, Burlington-Edison High School, Fieldhouse 1984 Addition

17-38 Nonstructural Checklist

Notes:

C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Performance Level: HR = Hazards Reduced, LS = Life Safety, and PR = Position Retention.

Level of Seismicity: L = Low, M = Moderate, and H = High

Life Safety Systems

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LSS-1 Fire Suppression Piping. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping is anchored and braced in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.1)			X		The building does not have a fire suppression system.
LSS-2 Flexible Couplings. HR-not required; LS-LMH; PR-LMH.	Fire suppression piping has flexible couplings in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.2)			X		The building does not have a fire suppression system.
LSS-3 Emergency Power. HR-not required; LS-LMH; PR-LMH.	Equipment used to power or control Life Safety systems is anchored or braced. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.1)				X	Emergency power systems were not verified with maintenance or facility staff. Facility staff should verify the use of backup power to control Life Safety systems. If used, further investigation should be performed to determine if seismic anchorage is adequate.
LSS-4 Stair and Smoke Ducts. HR-not required; LS-LMH; PR-LMH.	Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.1)			X		The building is a single-story structure.
LSS-5 Sprinkler Ceiling Clearance. HR-not required; LS-MH; PR-MH.	Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (Tier 2: Sec. 13.7.4; Commentary: Sec. A.7.13.3)			X		The building does not have a fire suppression system.
LSS-6 Emergency Lighting. HR-not required; LS-not required; PR-LMH	Emergency and egress lighting equipment is anchored or braced. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.1)			X		

Hazardous Materials

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
HM-1 Hazardous Material Equipment. HR-LMH; LS-LMH; PR-LMH.	Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.2)			X		

HM-2 Hazardous Material Storage. HR-LMH; LS-LMH; PR-LMH.	Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 13.8.3; Commentary: Sec. A.7.15.1)			X		Breakable containers with hazardous contents were not observed.
HM-3 Hazardous Material Distribution. HR-MH; LS-MH; PR-MH.	Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)				X	The building has natural gas piping. However, the details of how the piping is anchored are not known. Further investigation should be performed to determine if the natural gas piping is seismically adequate.
HM-4 Shutoff Valves. HR-MH; LS-MH; PR-MH.	Piping containing hazardous material, including natural gas, has shutoff valves or other devices to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.3)				X	It is unknown whether shutoff valves exist. If they do not exist, installation of shutoff valves may be appropriate to reduce seismic risk.
HM-5 Flexible Couplings. HR-LMH; LS-LMH; PR-LMH.	Hazardous material ductwork and piping, including natural gas piping, have flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.15.4)				X	It is unknown whether natural gas piping has flexible couplings. If they do not exist, installation of flexible couplings may be appropriate to reduce seismic risk.
HM-6 Piping or Ducts Crossing Seismic Joints. HR-MH; LS-MH; PR-MH.	Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.3, 13.7.5, 13.7.6; Commentary: Sec. A.7.13.6)				X	The building does not have explicit seismic joints, but the building does have different wings built at different times. It is not known if natural gas piping crosses between different wings of the building. Further investigation of the natural gas piping is recommended.

Partitions

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
P-1 Unreinforced Masonry. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft (3.0 m) in Low or Moderate Seismicity, or at most 6 ft (1.8 m) in High Seismicity. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.1)			X		

P-2 Heavy Partitions Supported by Ceilings. HR-LMH; LS-LMH; PR-LMH.	The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)			X		
P-3 Drift. HR-not required; LS-MH; PR-MH.	Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.2)			X		
P-4 Light Partitions Supported by Ceilings. HR-not required; LS-not required; PR-MH.	The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.2.1)			X		
P-5 Structural Separations. HR-not required; LS-not required; PR-MH.	Partitions that cross structural separations have seismic or control joints. (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.3)			X		
P-6 Tops. HR-not required; LS-not required; PR-MH.	The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft (1.8 m). (Tier 2: Sec. 13.6.2; Commentary: Sec. A.7.1.4)			X		

Ceilings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
C-1 Suspended Lath and Plaster. HR-H; LS-MH; PR-LMH.	Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft ² (1.1 m ²) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		
C-2 Suspended Gypsum Board. HR-not required; LS-MH; PR-LMH.	Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft ² (1.1 m ²) of area. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.3)			X		
C-3 Integrated Ceilings. HR-not required; LS-not required; PR-MH.	Integrated suspended ceilings with continuous areas greater than 144 ft ² (13.4 m ²) and ceilings of smaller areas that are not surrounded by restraining partitions are laterally restrained at a spacing no greater than 12 ft (3.6 m) with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.2)			X		Not required for life safety performance level.

C-4 Edge Clearance. HR-not required; LS-not required; PR-MH.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft ² (13.4 m ²) have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in. (13 mm); in High Seismicity, 3/4 in. (19 mm). (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.4)			X		Not required for life safety performance level.
C-5 Continuity Across Structure Joints. HR-not required; LS-not required; PR-MH.	The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.5)			X		Not required for life safety performance level.
C-6 Edge Support. HR-not required; LS-not required; PR-H.	The free edges of integrated suspended ceilings with continuous areas greater than 144 ft ² (13.4 m ²) are supported by closure angles or channels not less than 2 in. (51 mm) wide. (Tier 2: Sec. 13.6.4 ; Commentary: Sec. A.7.2.6)			X		Not required for life safety performance level.
C-7 Seismic Joints. HR-not required; LS-not required; PR-H.	Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2,500 ft ² (232.3 m ²) and has a ratio of long-to-short dimension no more than 4-to-1. (Tier 2: Sec. 13.6.4; Commentary: Sec. A.7.2.7)			X		Not required for life safety performance level.

Light Fixtures

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
LF-1 Independent Support. HR-not required; LS-MH; PR-MH.	Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (Tier 2: Sec. 13.6.4, 13.7.9; Commentary: Sec. A.7.3.2)	X				Light fixtures appear to have independent wire supports and, or do not penetrate ceilings or are heavier than the ceilings they penetrate.
LF-2 Pendant Supports. HR-not required; LS-not required; PR-H.	Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft. Unbraced suspended fixtures are free to allow a 360-degree range of motion at an angle not less than 45 degrees from horizontal without contacting adjacent components. Alternatively, if rigidly supported and/or braced, they are free to move with the structure to which they are attached without damaging adjoining components. Additionally, the connection to the structure is capable of accommodating the movement without failure. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.3)			X		Not required for life safety performance level.
LF-3 Lens Covers. HR-not required; LS-not required; PR-H.	Lens covers on light fixtures are attached with safety devices. (Tier 2: Sec. 13.7.9; Commentary: Sec. A.7.3.4)			X		Not required for life safety performance level.

Cladding and Glazing

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CG-1 Cladding Anchors. HR-MH; LS-MH; PR-MH.	Cladding components weighing more than 10 lb/ft ² (0.48 kN/m ²) are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft (1.8 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft (1.2 m) (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.1)			X		The building does not have cladding panels.
CG-2 Cladding Isolation. HR-not required; LS-MH; PR-MH.	For steel or concrete moment-frame buildings, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.3)			X		
CG-3 Multi-Story Panels. HR-MH; LS-MH; PR-MH.	For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.4)			X		
CG-4 Threaded Rods. HR-not required; LS-MH; PR-MH.	Threaded rods for panel connections detailed to accommodate drift by bending of the rod have a length-to-diameter ratio greater than 0.06 times the story height in inches for Life Safety in Moderate Seismicity and 0.12 times the story height in inches for Life Safety in High Seismicity and Position Retention in any seismicity. (Tier 2: Sec. 13.6.1; Commentary: Sec. A.7.4.9)			X		
CG-5 Panel Connections. HR-MH; LS-MH; PR-MH.	Cladding panels are anchored out of plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.5)			X		

CG-6 Bearing Connections. HR-MH; LS-MH; PR-MH.	Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.6)			X		
CG-7 Inserts. HR-MH; LS-MH; PR-MH.	Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (Tier 2: Sec. 13.6.1.4; Commentary: Sec. A.7.4.7)			X		
CG-8 Overhead Glazing. HR-not required; LS-MH; PR-MH.	Glazing panes of any size in curtain walls and individual interior or exterior panes more than 16 ft ² (1.5 m ²) in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (Tier 2: Sec. 13.6.1.5; Commentary: Sec. A.7.4.8)			X		

Masonry Veneer

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
M-1 Ties. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft ² (0.25 m ²), and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in. (914 mm); for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (610 mm). (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.1)			X		The building exterior is structural masonry, not masonry veneer.
M-2 Shelf Angles. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.2)			X		
M-3 Weakened Planes. HR-not required; LS-LMH; PR-LMH.	Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.3)			X		
M-4 Unreinforced Masonry Backup. HR-LMH; LS-LMH; PR-LMH.	There is no unreinforced masonry backup. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.2)			X		
M-5 Stud Tracks. HR-not required; LS-MH; PR-MH.	For veneer with coldformed steel stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. (610 mm) on center. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.)			X		
M-6 Anchorage. HR-not required; LS-MH; PR-MH.	For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.7.1)			X		

M-7 Weep Holes. HR-not required; LS-not required; PR-MH.	In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (Tier 2: Sec. 13.6.1.2; Commentary: Sec. A.7.5.6)			X		Not required for life safety performance level.
M-8 Openings. HR-not required; LS-not required; PR-MH.	For veneer with cold-formed-steel stud backup, steel studs frame window and door openings. (Tier 2: Sec. 13.6.1.1, 13.6.1.2; Commentary: Sec. A.7.6.2)			X		Not required for life safety performance level.

Parapets, Cornices, Ornamentation, and Appendages

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PCOA-1 URM Parapets or Cornices. HR-LMH; LS-LMH; PR-LMH.	Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.1)			X		The building does not have URM parapets.
PCOA-2 Canopies. HR-not required; LS-LMH; PR-LMH.	Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft (3.0 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft (1.8 m). (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.2)	X				
PCOA-3 Concrete Parapets. HR-H; LS-MH; PR-LMH.	Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (Tier 2: Sec. 13.6.5; Commentary: Sec. A.7.8.3)			X		The building does not have concrete parapets.
PCOA-4 Appendages. HR-MH; LS-MH; PR-LMH.	Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft (1.8 m). This evaluation statement item does not apply to parapets or cornices covered by other evaluation statements. (Tier 2: Sec. 13.6.6; Commentary: Sec. A.7.8.4)			X		

Masonry Chimneys

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
MC-1 URM Chimneys. HR-LMH; LS-LMH; PR-LMH.	Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.1)			X		

MC-2 Anchorage. HR-LMH; LS-LMH; PR-LMH.	Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (Tier 2: Sec. 13.6.7; Commentary: Sec. A.7.9.2)			X		
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Stairs

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
S-1 Stair Enclosures. HR-not required; LS-LMH; PR-LMH.	Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out of plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (Tier 2: Sec. 13.6.2, 13.6.8; Commentary: Sec. A.7.10.1)			X		
S-2 Stair Details. HR-not required; LS-LMH; PR-LMH.	The connection between the stairs and the structure does not rely on post-installed anchors in concrete or masonry, and the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.4.3.1 for moment-frame structures or 0.5 in. for all other structures without including any lateral stiffness contribution from the stairs. (Tier 2: Sec. 13.6.8; Commentary: Sec. A.7.10.2)			X		

Contents and Furnishings

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
CF-1 Industrial Storage Racks. HR-LMH; LS-MH; PR-MH.	Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/RMI MH 16.1 as modified by ASCE 7, Chapter 15. (Tier 2: Sec. 13.8.1; Commentary: Sec. A.7.11.1)			X		
CF-2 Tall Narrow Contents. HR-not required; LS-H; PR-MH.	Contents more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.2)	X				
CF-3 Fall-Prone Contents. HR-not required; LS-H; PR-H.	Equipment, stored items, or other contents weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level are braced or otherwise restrained. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.3)	X				
CF-4 Access Floors. HR-not required; LS-not required; PR-MH.	Access floors more than 9 in. (229 mm) high are braced. (Tier 2: Sec. 13.6.10; Commentary: Sec. A.7.11.4)			X		Not required for life safety performance level.

CF-5 Equipment on Access Floors. HR-not required; LS-not required; PR-MH.	Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (Tier 2: Sec. 13.7.7 13.6.10; Commentary: Sec. A.7.11.5)			X		Not required for life safety performance level.
CF-6 Suspended Contents. HR-not required; LS-not required; PR-H.	Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (Tier 2: Sec. 13.8.2; Commentary: Sec. A.7.11.6)			X		Not required for life safety performance level.

Mechanical and Electrical Equipment

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
ME-1 Fall-Prone Equipment. HR-not required; LS-H; PR-H.	Equipment weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level, and which is not in-line equipment, is braced. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.4)				X	The types of large equipment and the manner in which that equipment is braced is unknown. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-2 In-Line Equipment. HR-not required; LS-H; PR-H.	Equipment installed in line with a duct or piping system, with an operating weight more than 75 lb (34.0 kg), is supported and laterally braced independent of the duct or piping system. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.5)				X	The types and locations of in-line equipment (if any) and their bracing is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-3 Tall Narrow Equipment. HR-not required; LS-H; PR-MH.	Equipment more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (Tier 2: Sec. 13.7.1 13.7.7; Commentary: Sec. A.7.12.6)				X	The manner in which tall narrow equipment is braced is not known. Further investigation is recommended if determination of compliance or noncompliance is desired.
ME-4 Mechanical Doors. HR-not required; LS-not required; PR-MH.	Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (Tier 2: Sec. 13.6.9; Commentary: Sec. A.7.12.7)			X		Not required for life safety performance level.
ME-5 Suspended Equipment. HR-not required; LS-not required; PR-H.	Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.8)			X		Not required for life safety performance level.

ME-6 Vibration Isolators. HR-not required; LS-not required; PR-H.	Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (Tier 2: Sec. 13.7.1; Commentary: Sec. A.7.12.9)			X		Not required for life safety performance level.
ME-7 Heavy Equipment. HR-not required; LS-not required; PR-H.	Floor supported or platform-supported equipment weighing more than 400 lb (181.4 kg) is anchored to the structure. (Tier 2: Sec. 13.7.1, 13.7.7; Commentary: Sec. A.7.12.10)			X		Not required for life safety performance level.
ME-8 Electrical Equipment. HR-not required; LS-not required; PR-H.	Electrical equipment is laterally braced to the structure. (Tier 2: Sec. 13.7.7; Commentary: Sec. A.7.12.11)			X		Not required for life safety performance level.
ME-9 Conduit Couplings. HR-not required; LS-not required; PR-H.	Conduit greater than 2.5 in. (64 mm) trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (Tier 2: Sec. 13.7.8; Commentary: Sec. A.7.12.12)			X		Not required for life safety performance level.

Piping

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
PP-1 Flexible Couplings. HR-not required; LS-not required; PR-H.	Fluid and gas piping has flexible couplings. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.2)			X		Not required for life safety performance level.
PP-2 Fluid and Gas Piping. HR-not required; LS-not required; PR-H.	Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.4)			X		Not required for life safety performance level.
PP-3 C-Clamps. HR-not required; LS-not required; PR-H.	One-sided C-clamps that support piping larger than 2.5 in. (64 mm) in diameter are restrained. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.5)			X		Not required for life safety performance level.
PP-4 Piping Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.3, 13.7.5; Commentary: Sec. A.7.13.6)			X		Not required for life safety performance level.

Ducts

EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
D-1 Duct Bracing. HR-not required; LS-not required; PR-H.	Rectangular ductwork larger than 6 ft ² (0.56 m ²) in cross-sectional area and round ducts larger than 28 in. (711 mm) in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft (9.2 m). The maximum spacing of longitudinal bracing does not exceed 60 ft (18.3 m). (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.2)			X		Not required for life safety performance level.

D-2 Duct Support. HR-not required; LS-not required; PR-H.	Ducts are not supported by piping or electrical conduit. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.3)			X		Not required for life safety performance level.
D-3 Ducts Crossing Seismic Joints. HR-not required; LS-not required; PR-H.	Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (Tier 2: Sec. 13.7.6; Commentary: Sec. A.7.14.4)			X		Not required for life safety performance level.

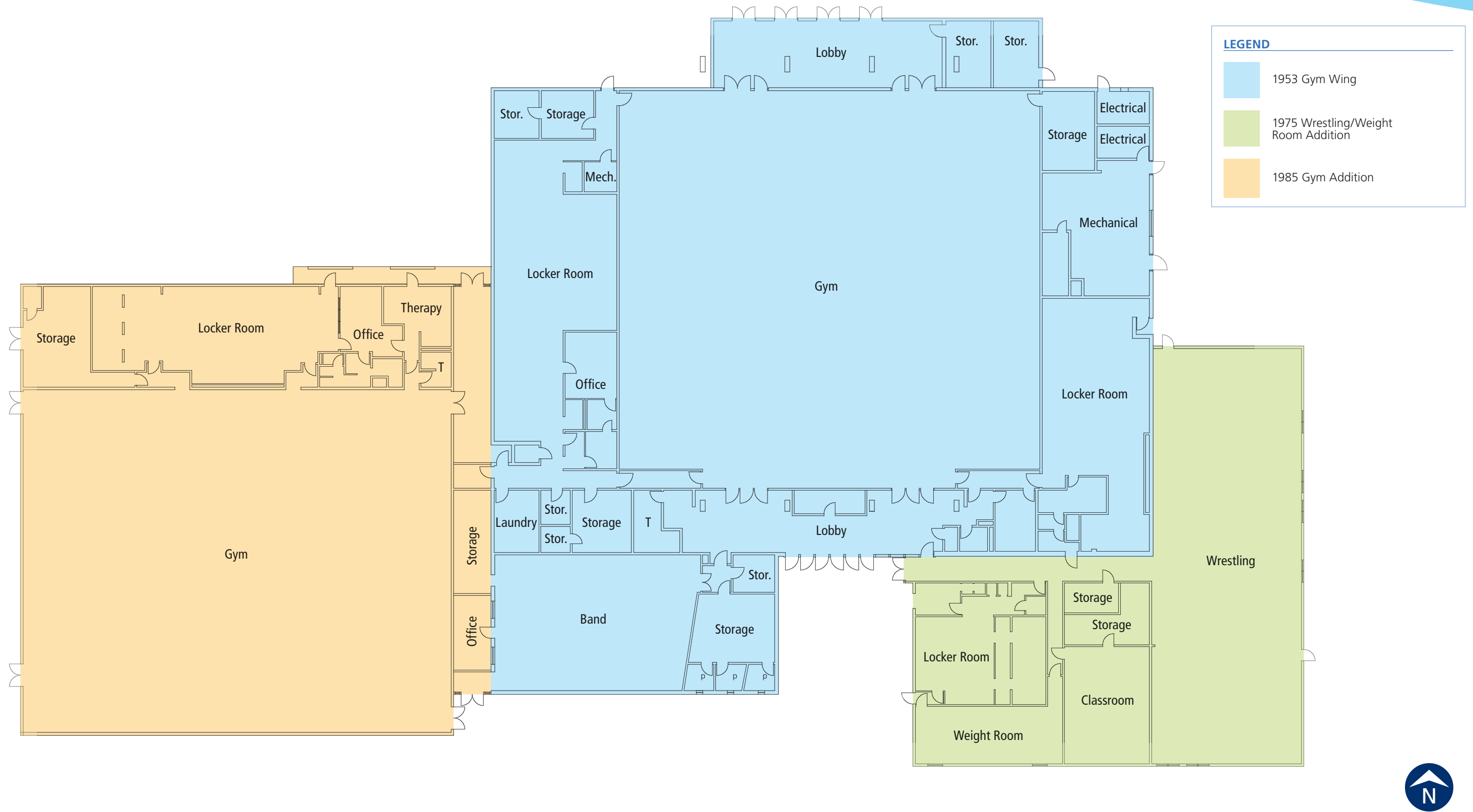
Elevators

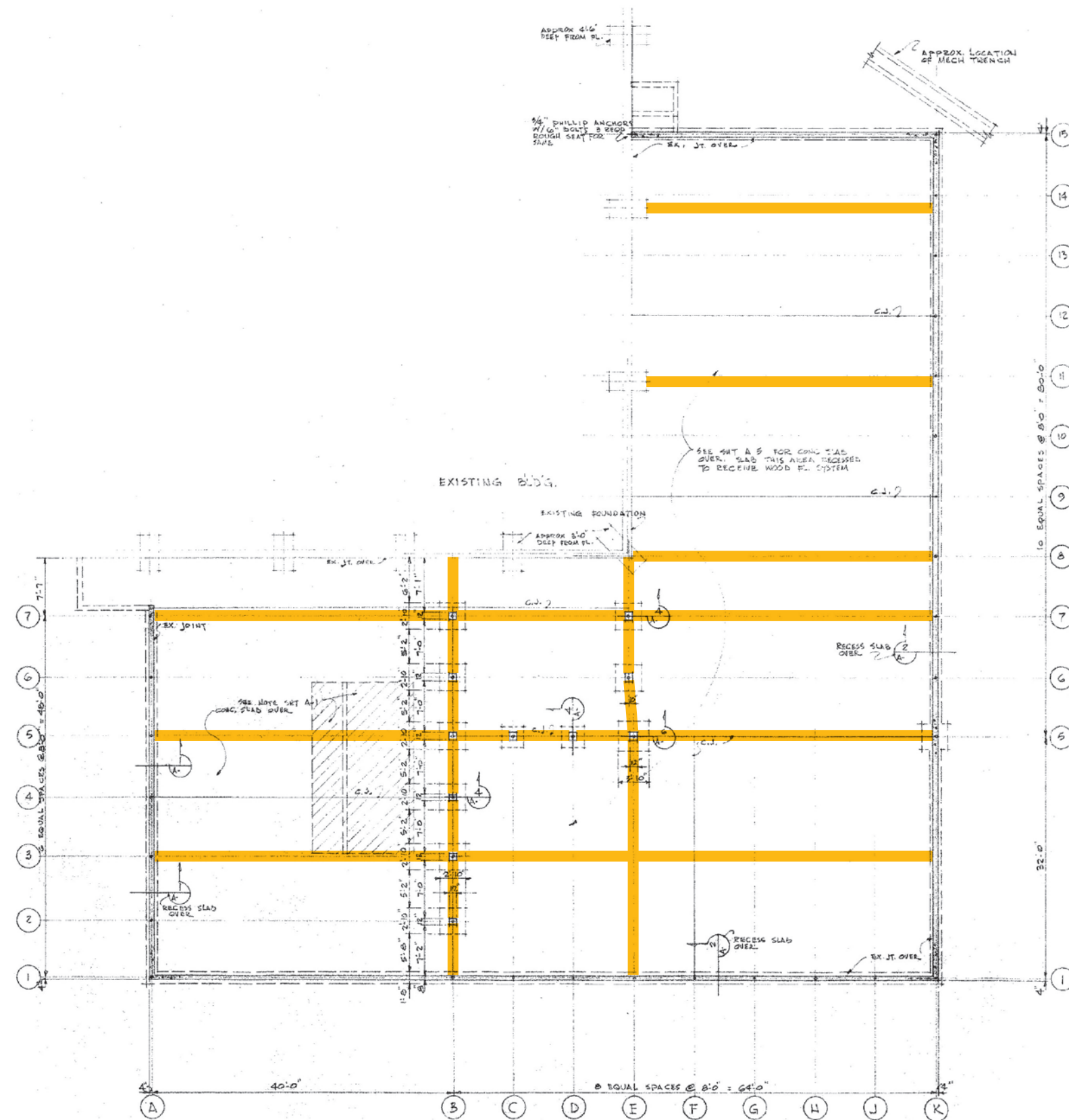
EVALUATION ITEM	EVALUATION STATEMENT	C	NC	N/A	U	COMMENT
EL-1 Retainer Guards. HR-not required; LS-H; PR-H.	Sheaves and drums have cable retainer guards. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.1)			X		The building does not have an elevator.
EL-2 Retainer Plate. HR-not required; LS-H; PR-H.	A retainer plate is present at the top and bottom of both car and counterweight. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.2)			X		
EL-3 Elevator Equipment. HR-not required; LS-not required; PR-H.	Equipment, piping, and other components that are part of the elevator system are anchored. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.3)			X		Not required for life safety performance level.
EL-4 Seismic Switch. HR-not required; LS-not required; PR-H.	Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.4)			X		Not required for life safety performance level.
EL-5 Shaft Walls. HR-not required; LS-not required; PR-H.	Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.5)			X		Not required for life safety performance level.
EL-6 Counterweight Rails. HR-not required; LS-not required; PR-H.	All counterweight rails and divider beams are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.6)			X		Not required for life safety performance level.
EL-7 Brackets. HR-not required; LS-not required; PR-H.	The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.7)			X		Not required for life safety performance level.
EL-8 Spreader Bracket. HR-not required; LS-not required; PR-H.	Spreader brackets are not used to resist seismic forces. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.8)			X		Not required for life safety performance level.
EL-9 Go-Slow Elevators. HR-not required; LS-not required; PR-H.	The building has a go-slow elevator system. (Tier 2: Sec. 13.7.11; Commentary: Sec. A.7.16.9)			X		Not required for life safety performance level.

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Appendix B: Concept-Level Seismic Upgrade Figures

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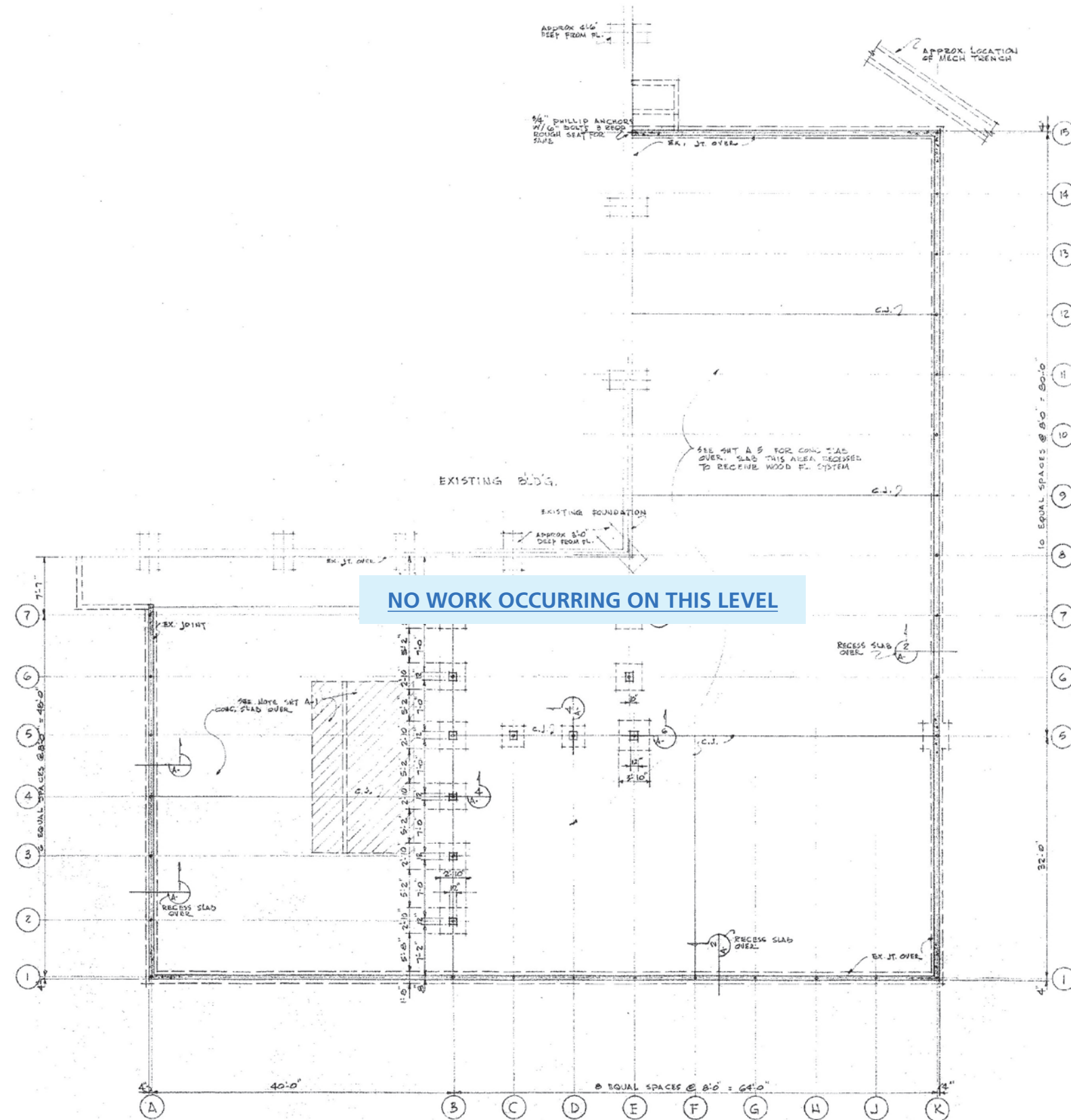
LEGEND

 Add Concrete Foundation Cross Tie Grade beams



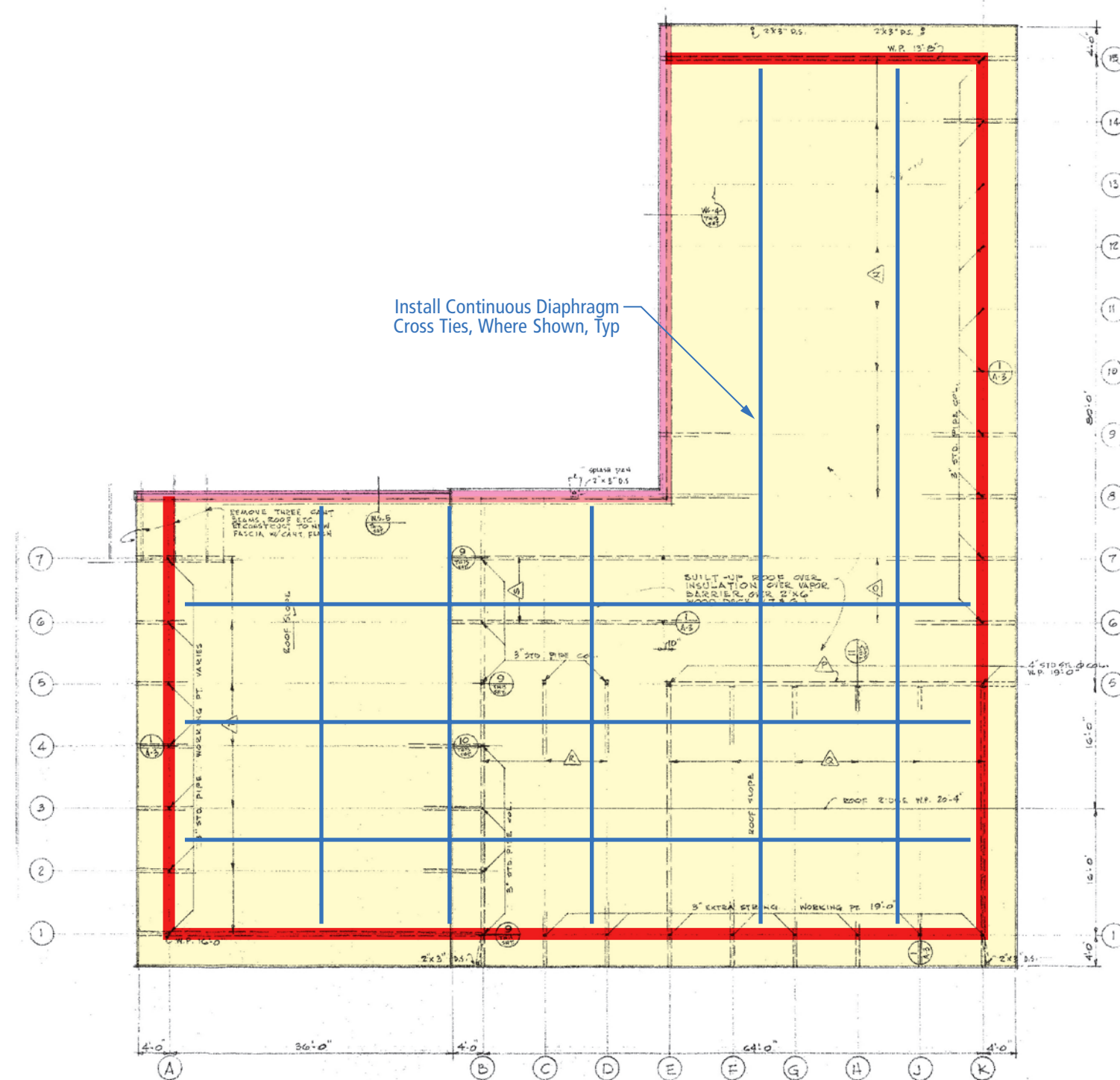
KEY PLAN





KEY PLAN





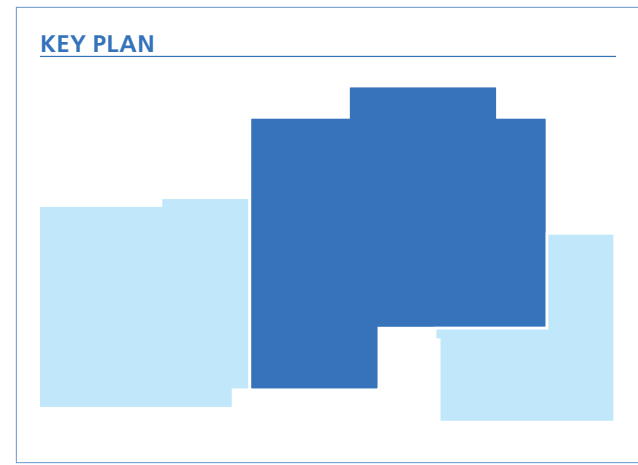
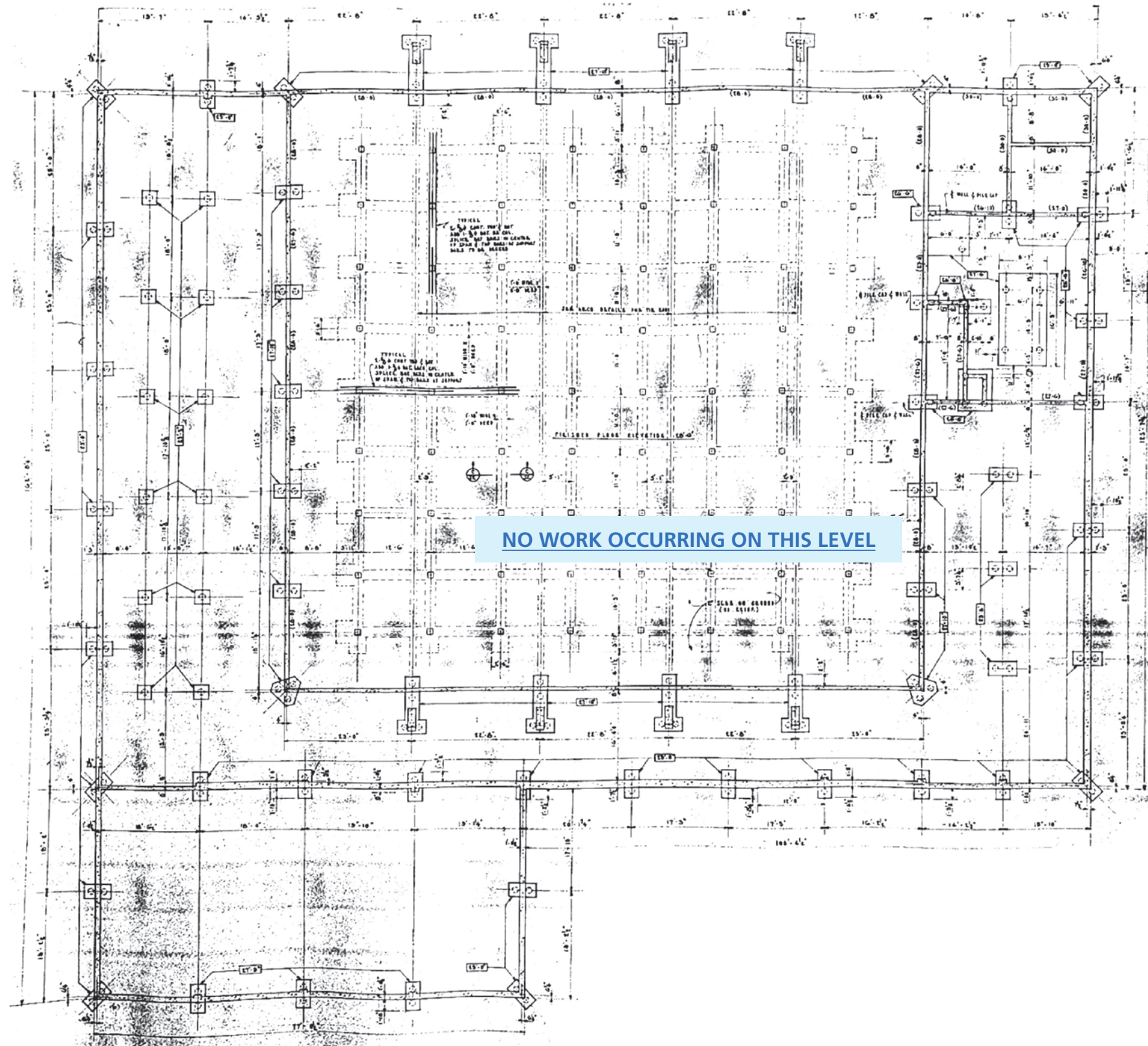
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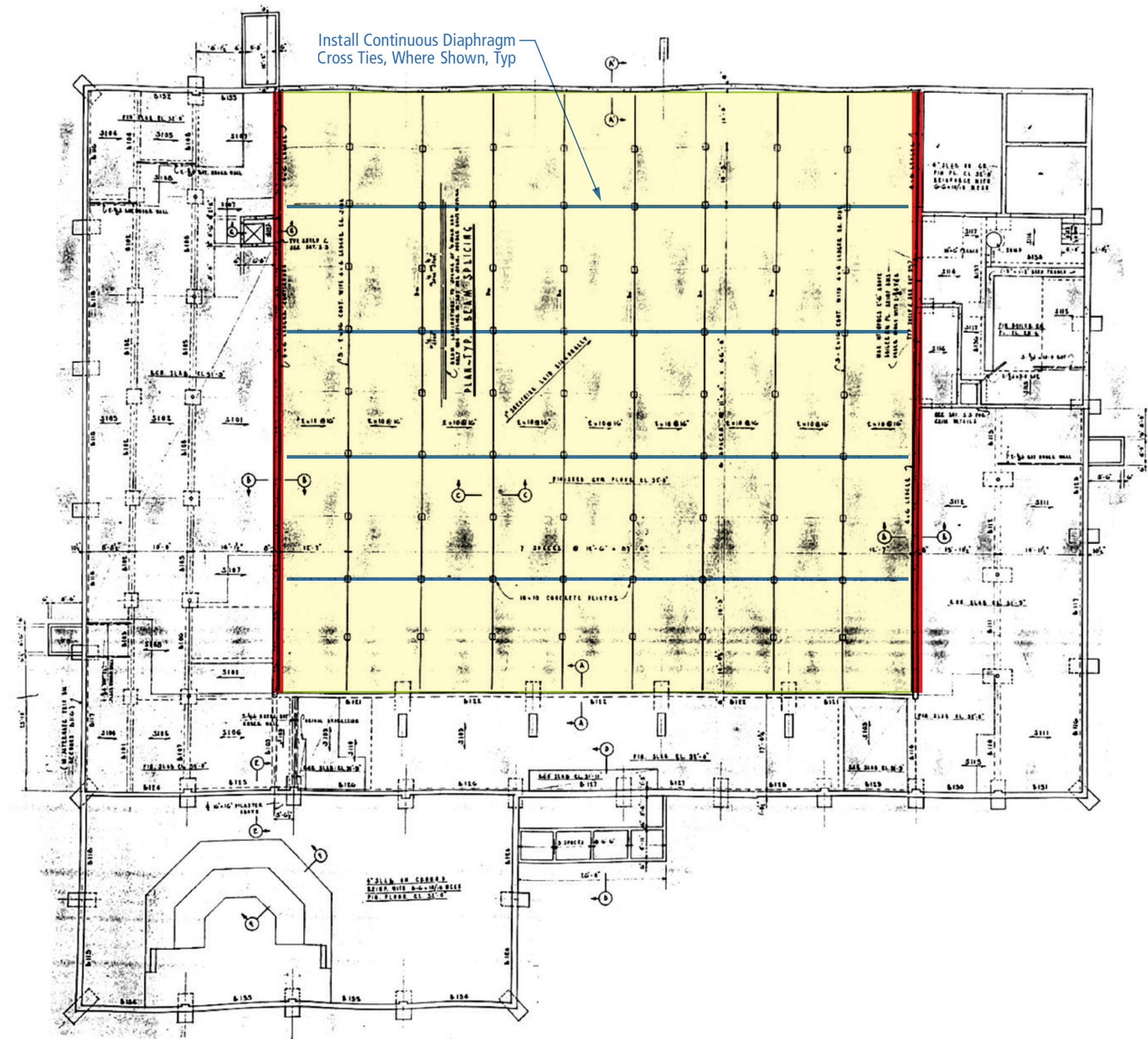
- Increase Strength of Connection From 1970s Portion of Structure to 1950s Portion of Structure & Strengthen Connection to Masonry Wall below
- Increase Strength of Connections From Roof to Exterior Wall
- Strengthen Roof Diaphragm by Adding Plywood Overlay Over Entire Extents of Roof



KEY PLAN







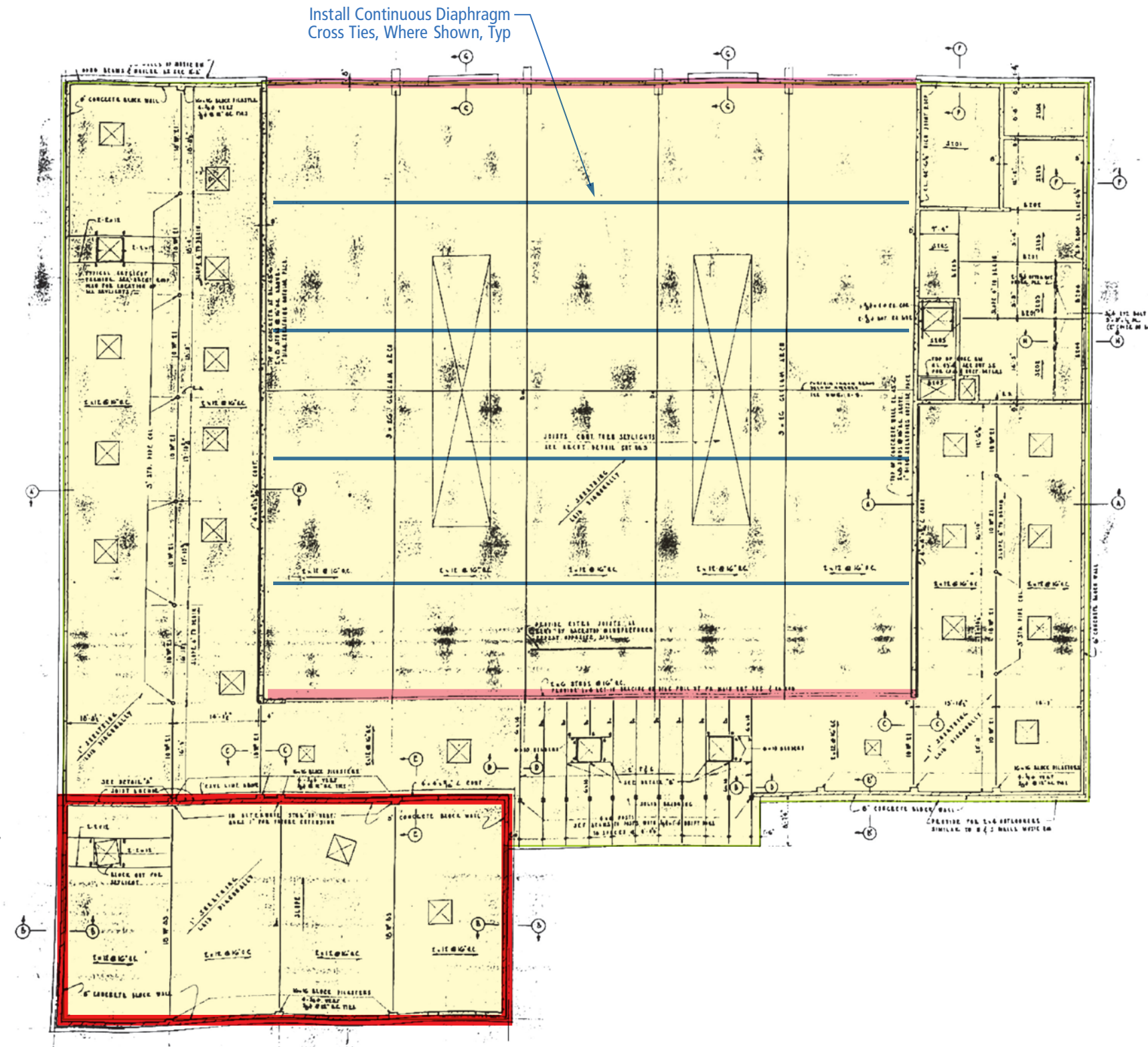
LEGEND

- Upgrade Exterior High-Roof Wood Walls to be Wood Structural Shear Walls, Each End
- Strengthen Floor Diaphragm by Adding Plywood Overlay Over Entire Extents of Gym Floor, Strengthen Connection to Perimeter Wall

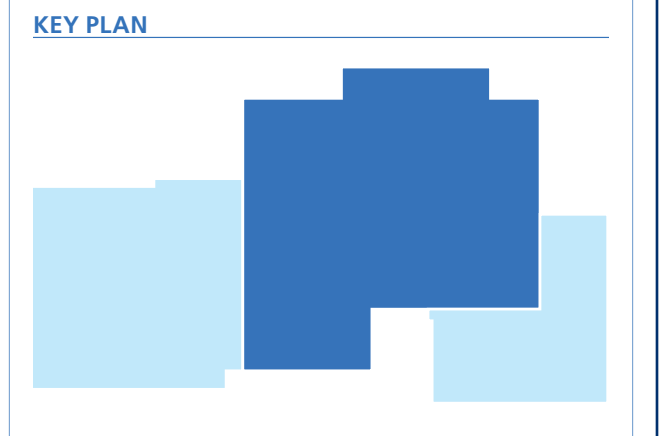


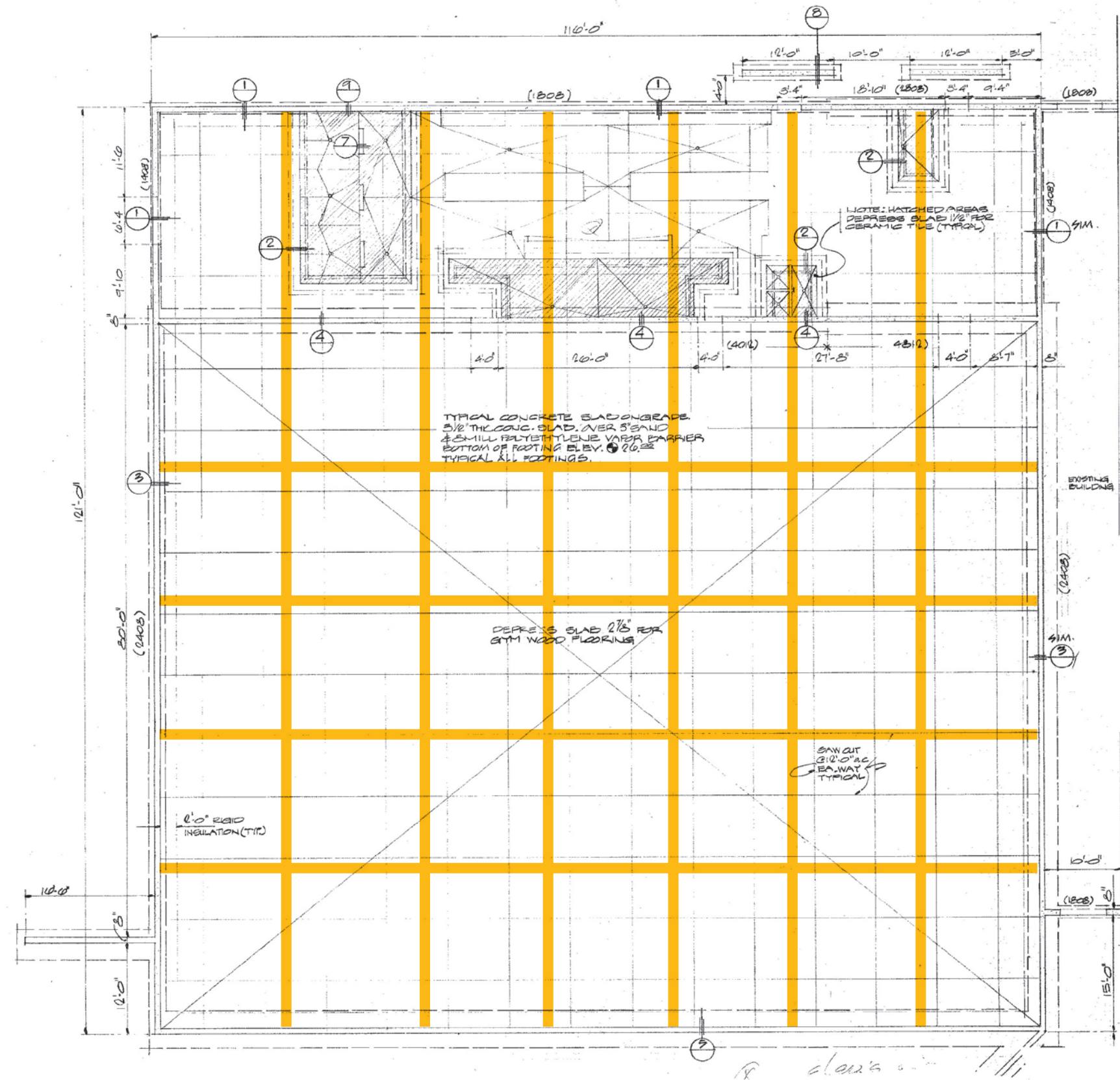
KEY PLAN





- LEGEND**
- Strengthen Connection From Roof to Concrete Walls below
 - Increase Strength of Connections From Roof to Masonry Walls below
 - Strengthen Roof Diaphragm by Adding Plywood Overlay Over Entire Extents of Roof





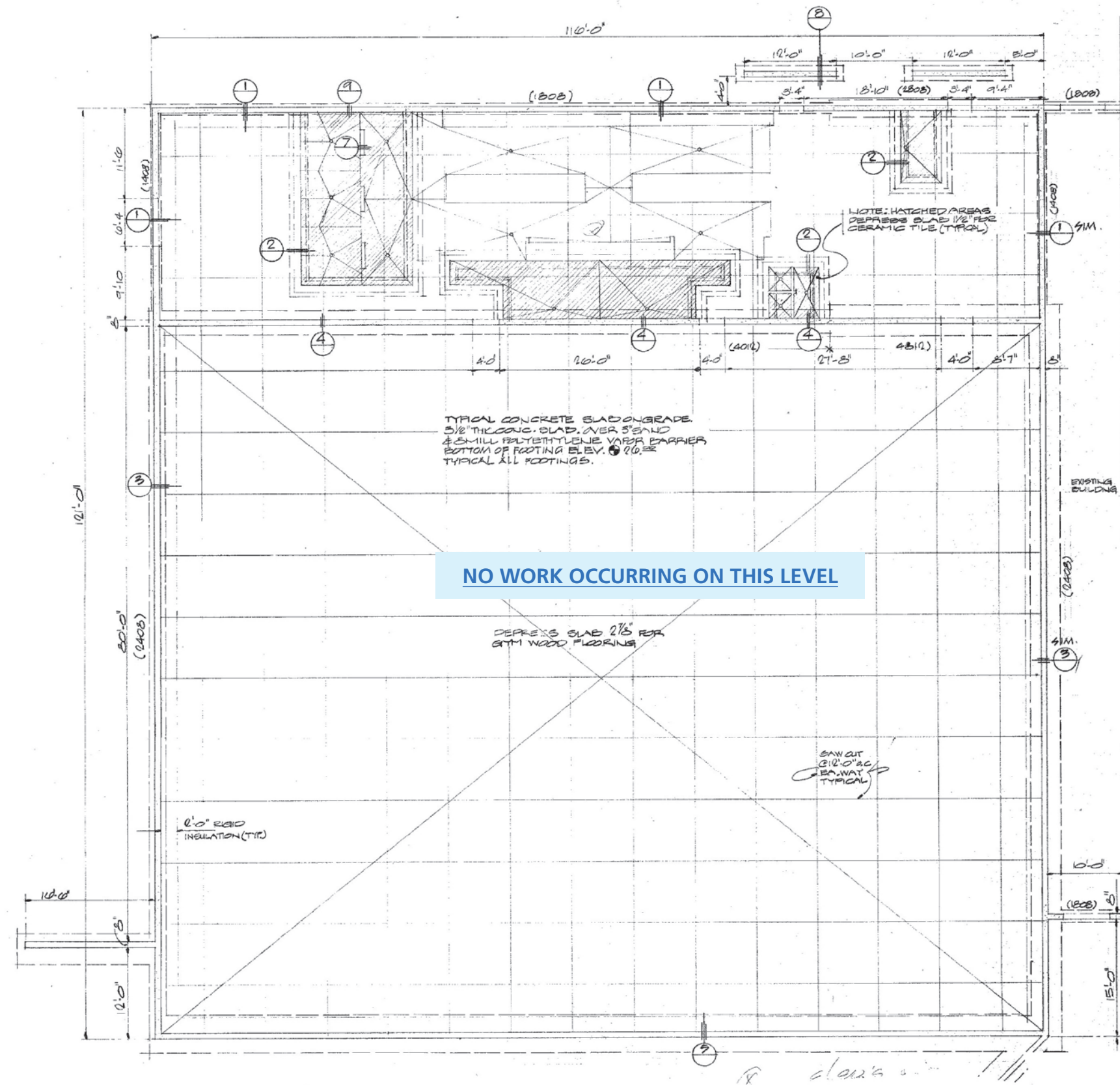
LEGEND

- Add Concrete Foundation Cross Tie Grade beams



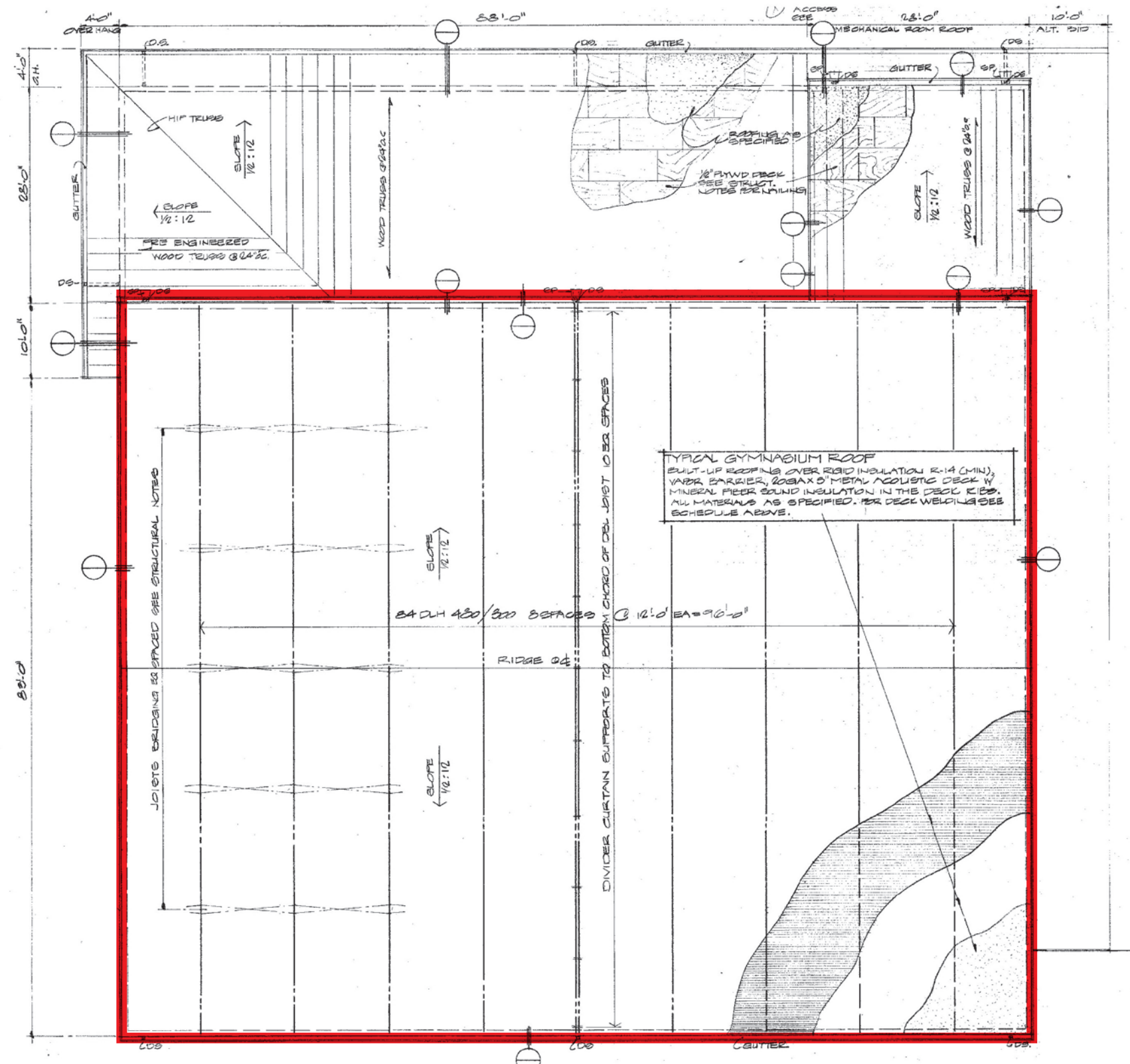
KEY PLAN





KEY PLAN





LEGEND

- █ Increase Strength of Connections From Roof to Masonry Walls below

KEY PLAN



Appendix C: Opinion of Probable Construction Costs

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520 Kirkland Way, Suite 301
Kirkland, WA 98033
tel: (425) 828-0500
fax: (425) 828-0700
www.prodims.com

Name: **Wa State School Seismic Safety
Assessment Phase 2**
Second Name: **Burlington-Edison High School Gym//**
Location: **Mount Vernon, WA**
Design Phase: **ROM Cost Estimates**
Date of Estimate: **December 18, 2020**
Date of Revision: **April 9, 2021**
Month of Cost Basis: **1Q, 2021**

Burlington-Edison High School Gym/Fieldhouse

Master Estimate Summary

Project Name	Construction Cost Type	Estimated Construction Cost
Burlington-Edison High School Gym/Fieldhouse	Structural Costs	\$3,432,217
Burlington-Edison High School Gym/Fieldhouse	Non-Structural Costs	\$1,029,665
TOTAL ESTIMATED CONSTRUCTION COST		\$4,461,882

Soft Costs	Soft Costs % Construction Cost	Estimated Soft Costs
Project Soft Cost Allowance	40.0%	\$1,784,753
		Sum of the Above
TOTAL ESTIMATED PROJECT COST		\$6,246,635

Estimate Assumptions:

The ROM Construction Cost estimates are based on the Concept Design Report for the Project.
Construction Escalation is not included. Costs are current as of the month of Cost Basis noted above right.

Estimate Qualifications:

The ROM estimates are not be relied on solely for proforma development and financial decisions.
Further design work is required to determine construction budgets.
All Buildings Estimated to the 5' foot line for Utilities, All Sitework is estimated to go with any combination of the buildings and alternatives.
The ROM estimates do not include any Hazardous Material Abatement/Disposal.
For Construction Cost Markups they are additive, not cumulative. Percentages are added to the previous subtotal rather than the direct cost subtotal.
Owner Soft Costs Allowance are: A/E design fees, QA/QC, Project Administration, Owners Project Contingency, Average Washington State Sale Tax and
Estimated labor is based on an 8 hour per day shift 5 days a week. Accelerated schedule work of overtime has not been included.
Estimated labor is based on working on unoccupied facility without phased construction.
Estimate is based on a competitive public bid with at least 3 bona fide submitted and unrescinded general contractor bids.
Estimate is based on a competitive public bid with a minimum 6 week bidding schedule and no significant addendums within 2 weeks of bid opening.
State of Washington General Contractor/ Construction Manager (GC/CM) contracts typically raises construction costs. It is Not Included in this estimate.
Estimated construction cost is for the entire project. This estimate is not intended to be used for other projects.
Please consult the cost estimator for any modifications to this estimate. Unilaterally adding and deleting markups, scope of work, schedule, specifications, plans and bid forms could incorrectly restate the project construction cost.
Construction reserve contingency for change orders is not included in the estimate.
Sole source supply of materials and/ or installers typically results in a 40% to 100% premium on costs over open specifications.



520 Kirkland Way, Suite 301
Kirkland, WA 98033
Phone: 425-828-0500 Fax: 425-828-0700
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Structural Costs

Burlington-Edison High School Gym/Fieldhouse

Wa State School Seismic
Name: Safety Assessment Phase 2
Areas sqft
Burlington-Edison High
Second Name: School Gym/Fieldhouse
Gym Building Area 50,000
Location: Mount Vernon, WA
Design Phase: ROM Cost Estimates
Date of Estimate: December 18, 2020
Date of Revision: April 9, 2021
Month of Cost Basis: 1Q, 2021
Total Areas 50,000

Construction Cost Estimate

Subtotal Direct Cost From the Estimate Detail Below \$ 2,331,802

	Percentage of Previous Subtotal	Amount	Running Subtotal
Scope Contingency	10.0%	\$ 233,180	\$ 2,564,982
General Conditions	10.0%	\$ 233,180	\$ 2,798,163
Home Office Overhead	5.0%	\$ 116,590	\$ 2,914,753
Profit	6.0%	\$ 139,908	\$ 3,054,661
Escalation Included-Costs in 4Q, 2021 Dollars	12.4%	\$ 377,556	\$ 3,432,217
Washington State Sales Tax - Included in Soft Costs			

Total Markups Applied to the Direct Cost 47.19%

Markups are multiplied on each subtotal- They are not multiplied from the direct cost

TOTAL ESTIMATED CONSTRUCTION COST--—————→	\$	3,432,217	\$	68.64
-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --—————→	\$	2,745,774	\$	54.92
+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE --—————→	\$	5,148,325	\$	102.97

Please see the Master Summary for Assumptions and Qualifications for ROM Cost Estimates

Direct Cost of Construction

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total \$/U of M	Direct Cost
-----	-------------	----------	--------	-------	-------------	----------	----------------	-----------	-----------------	-----------------	-------------

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total \$/U of M	Direct Cost
1 - Seismic Retrofit											
Foundations											
	Grade Beam System- Excavation, Backfill, Formwork, Concrete, Reinforcing and Detailing. Inside Existing Building.	237.6 cuyd	\$	499.20	\$ 118,624.71	\$ 280.80	\$ 66,726.40	\$ 46.80	\$ 11,121.07	\$ 826.80	\$ 196,472.18
	Add Post Base Clips at Existing Post and Footing - Minimum 2 per post	269 each	\$	166.50	\$ 44,788.50	\$ 55.50	\$ 14,929.50	\$ 13.32	\$ 3,583.08	\$ 235.32	\$ 63,301.08
Substructure											
	12" Slab on Grade System with #4 @ 12" o.c. EW Complete with Perimeter Insulation at New Grade Beam Installation.	22,200 sqft	\$	8.94	\$ 198,412.50	\$ 7.31	\$ 162,337.50	\$ 0.98	\$ 21,645.00	\$ 17.23	\$ 382,395.00
	Demo Existing Slab on Grade System for New Grade Beam Installation.	22,200 sqft	\$	4.28	\$ 94,905.00	\$ 0.23	\$ 4,995.00	\$ 0.27	\$ 5,994.00	\$ 4.77	\$ 105,894.00
Superstructure											
Upper Floor Systems											
	Add 15/32" Plywood Sheathing to Strengthen Floor Diaphragm at 1950's Gym	13,200 sqft	\$	0.96	\$ 12,616.56	\$ 0.81	\$ 10,747.44	\$ 0.11	\$ 1,401.84	\$ 1.88	\$ 24,765.84
	Add 2x12 with Post Installed Anchor at 16" o.c. to Strengthen Floor Diaphragm at 1950's Gym	460 lnft	\$	24.00	\$ 11,040.00	\$ 8.00	\$ 3,680.00	\$ 1.92	\$ 883.20	\$ 33.92	\$ 15,603.20
	Install Continuous Diaphragm Cross Ties - 4x8 with 4" wide light gauge coil strap with nails @ 3" OC	460 lnft	\$	6.21	\$ 2,856.60	\$ 5.29	\$ 2,433.40	\$ 0.69	\$ 317.40	\$ 12.19	\$ 5,607.40
Roof Systems											
	Add 15/32" Plywood Sheathing to Strengthen Roof Diaphragm at 1950's and 1970's Sections	37,500 sqft	\$	0.96	\$ 35,842.50	\$ 0.81	\$ 30,532.50	\$ 0.11	\$ 3,982.50	\$ 1.88	\$ 70,357.50
	Remove Existing Roofing Systems	37,500 sqft	\$	1.22	\$ 45,562.50	\$ 1.04	\$ 38,812.50	\$ 0.14	\$ 5,062.50	\$ 2.39	\$ 89,437.50
	Install Continuous Diaphragm Cross Ties - 4x8 with 4" wide light gauge coil strap with nails @ 3" OC	1,160 lnft	\$	6.21	\$ 7,203.60	\$ 5.29	\$ 6,136.40	\$ 0.69	\$ 800.40	\$ 12.19	\$ 14,140.40
	Strengthen Roof to Masonry Wall Connection - Assume 5/8" diameter post-installed masonry anchors @ 2'-0" OC, 1/4"x6" SDS at wood screws @ 6" OC - 1950' and 1970's wing	551 lnft	\$	71.10	\$ 39,176.10	\$ 18.90	\$ 10,413.90	\$ 5.40	\$ 2,975.40	\$ 95.40	\$ 52,565.40
	Add 2x12 with Post Installed Anchor at 16" o.c. to Strengthen Floor Diaphragm at 1950's Gym	230 lnft	\$	24.00	\$ 5,520.00	\$ 8.00	\$ 1,840.00	\$ 1.92	\$ 441.60	\$ 33.92	\$ 7,801.60

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total \$/U of M	Direct Cost
	Strengthen Roof to Wall Connections - Steel channel inserted under metal deck. Weld metal deck to channel with 3/4" puddle weld @ 1'-0" OC. Weld steel channel to new continuous 3/4"x1'-0" steel plate placed on top of wall with 4" long 1/4" fillet skip weld spaced at 12" OC. Connect steel plate to masonry wall below with 5/8" diameter post- installed masonry anchor @ 8" OC. at 1980's Gym	428 lnft	\$	147.68	\$ 63,207.95	\$ 60.32	\$ 25,817.33	\$ 12.48	\$ 5,341.52	\$ 220.48	\$ 94,366.79
	Strengthening Connection from 1970's to 1950's Portion of Structure: Added 2x8 blocking with (2) rows of 12d nails @ 3" OC, (3) added Simpson A35 clips spaced at 2'-0" OC, 5/8" diameter post-installed masonry anchors @ 2'-0" OC	130 lnft	\$	68.68	\$ 8,928.40	\$ 32.32	\$ 4,201.60	\$ 6.06	\$ 787.80	\$ 107.06	\$ 13,917.80
	Exterior Closure Exterior Wall System										
	Upgrade Exterior Wall High-Roof Wood Walls to be Structural Shear Walls - 15/32" Plywood and Horizontal Wall Blocking at 4'-0" o.c.	5,500 sqft	\$	1.79	\$ 9,831.25	\$ 1.46	\$ 8,043.75	\$ 0.20	\$ 1,072.50	\$ 3.45	\$ 18,947.50
	Remove and Restore Exterior Wall Finish System to install Exterior Wall High-Roof Structural Shear Walls	5,500 sqft	\$	15.40	\$ 84,700.00	\$ 12.60	\$ 69,300.00	\$ 1.68	\$ 9,240.00	\$ 29.68	\$ 163,240.00
	Roofing System										
	Low Slope Roofing System with R-25 Min Rigid Insulation, Flashing and Trim, Interior/Scupper Downspout Roof Drainage - Complete System	37,500 sqft	\$	8.78	\$ 329,062.50	\$ 10.73	\$ 402,187.50	\$ 1.17	\$ 43,875.00	\$ 20.67	\$ 775,125.00
	Interiors Interior Wall/Door/Finishes/Casework/Specialties Systems										
	Remove and Reinstall New Gym Floor System Including Markings	13,200 sqft	\$	10.54	\$ 139,128.00	\$ 6.46	\$ 85,272.00	\$ 1.02	\$ 13,464.00	\$ 18.02	\$ 237,864.00
										\$	-
	Subtotal of the Direct Cost of Construction Burlington-Edison High School Gym/Fieldhouse									\$	2,331,802



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Kirkland, WA 98033
Phone: 425-828-0500 Fax: 425-828-0700
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Non-Structural Costs

Burlington-Edison High School Gym/Fieldhouse

Wa State School Seismic
Name: Safety Assessment Phase 2
Areas sqft
Burlington-Edison High
School Gym/Fieldhouse
Gym Building Area 50,000
Location: Mount Vernon, WA
Design Phase: ROM Cost Estimates
Date of Estimate: December 18, 2020
Date of Revision: April 9, 2021
Month of Cost Basis: 1Q, 2021
Total Areas 50,000

Construction Cost Estimate

Subtotal Direct Cost From the Estimate Detail Below \$				699,541
	Percentage of Previous Subtotal	Amount	Running Subtotal	
Scope Contingency	10.0%	\$ 69,954	\$	769,495
General Conditions	10.0%	\$ 69,954	\$	839,449
Home Office Overhead	5.0%	\$ 34,977	\$	874,426
Profit	6.0%	\$ 41,972	\$	916,398
Escalation Included-Costs in 4Q, 2021 Dollars	12.4%	\$ 113,267	\$	1,029,665
Washington State Sales Tax - Included in Soft Costs				
Total Markups Applied to the Direct Cost		47.19%		
Markups are multiplied on each subtotal- They are not multiplied from the direct cost				
TOTAL ESTIMATED CONSTRUCTION COST-->			\$ 1,029,665	\$ 20.59
-20% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE -->			\$ 823,732	\$ 16.47
+50% TOTAL ESTIMATED CONSTRUCTION COST VARIANCE -->			\$ 1,544,498	\$ 30.89

Please see the Master Summary for Assumptions and Qualifications for ROM Cost Estimates

Direct Cost of Construction

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total \$/U of M	Direct Cost
2- Non- Structural Demo/Restoration*											
Interiors and M/E/P/FP systems											
	Mechanical/Electrical/Fire Protection Systems *	50,000 sqft		\$ 7.26	\$ 362,969.21	\$ 5.94	\$ 296,974.81	\$ 0.79	\$ 39,596.64	\$ 13.99	\$ 699,540.66
*Allows 30 percent of existing nonstructural systems M/E/P/FP require upgrades/replacement.											
Subtotal of the Direct Cost of Construction				Burlington-Edison High School Gym/Fieldhouse						\$	699,541

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Appendix D: Earthquake Performance Assessment Tool (EPAT) Worksheet

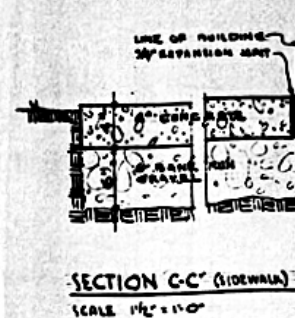
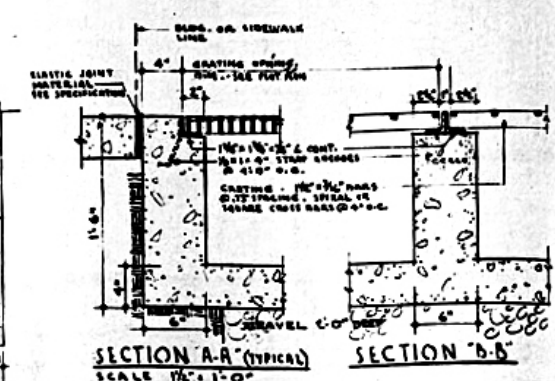
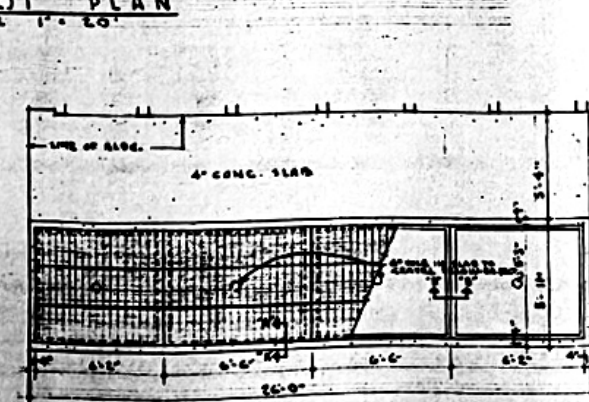
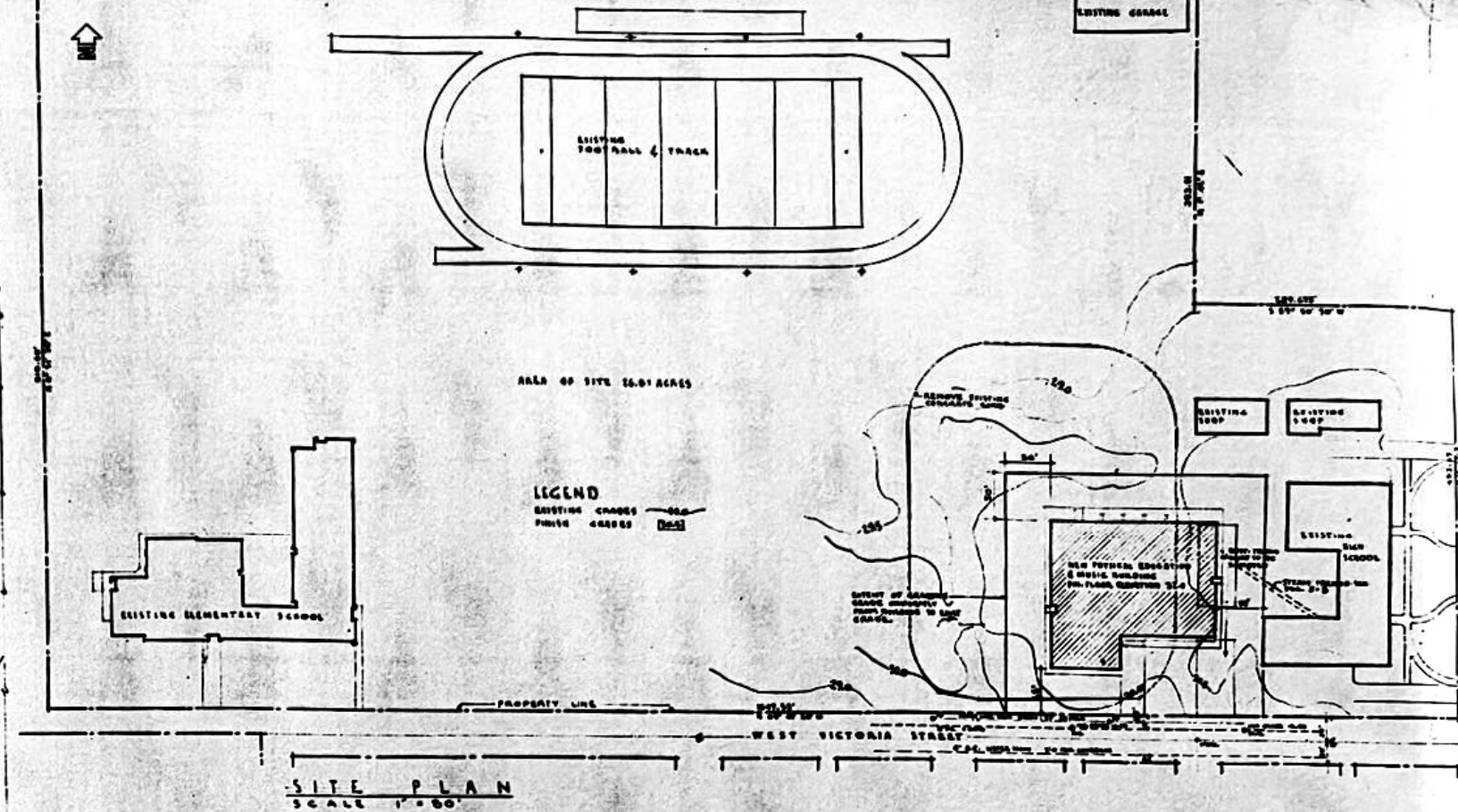
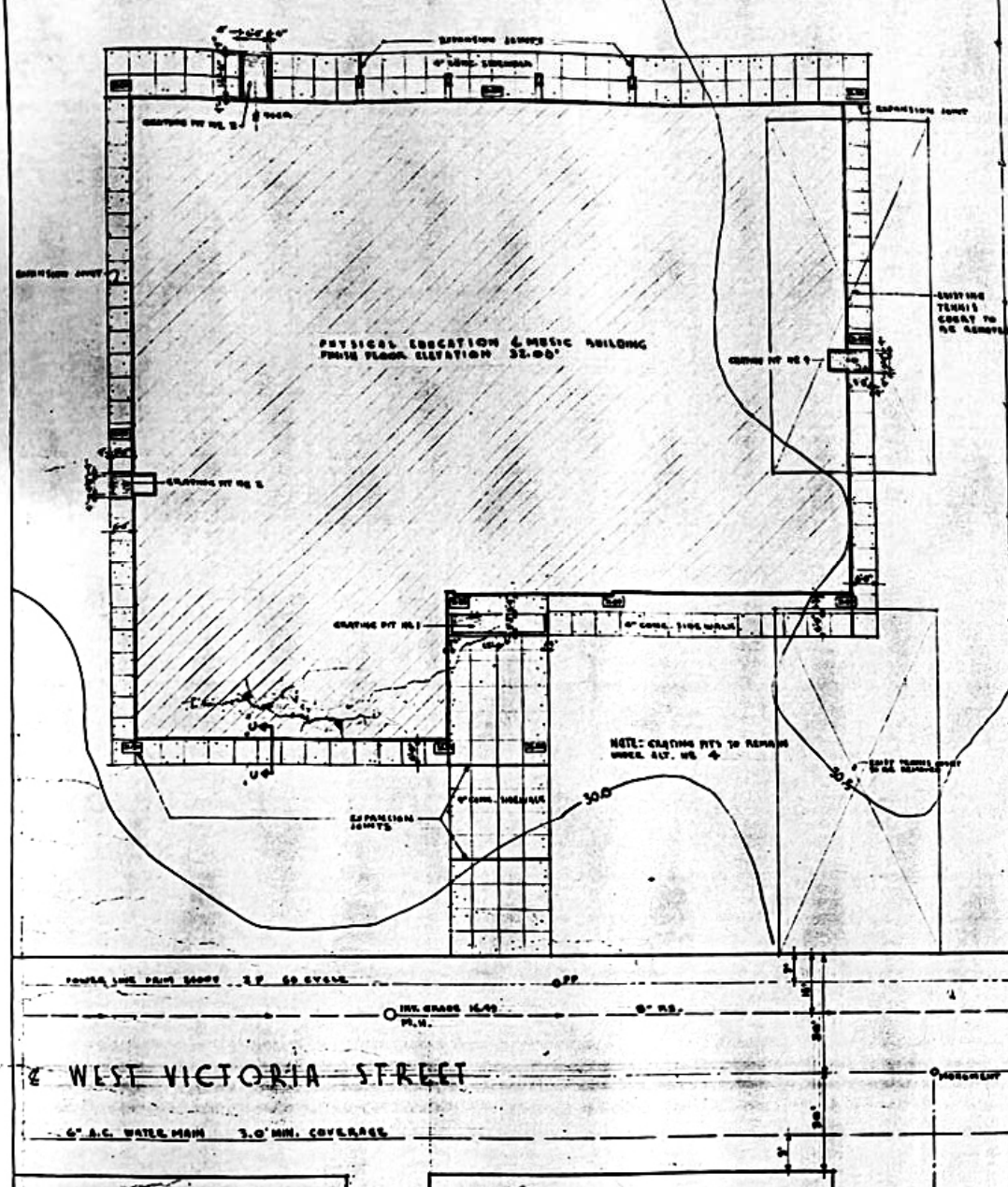
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Washington Schools Earthquake Performance Assessment Tool (EPAT)				
RESULTS SUMMARY				
District Name	Burlington-Edison		Existing Building Life Safety Risk & Priority for Retrofit or Replacement	
School Name	Burlington-Edison High School			
Building Name	Fieldhouse 1953 and 1975			
Very High				
Building Data				
HAZUS Building Type	RM1	Reinforced Masonry Bearing Walls w/ Wood or Metal Diaphragms		
Year Built	1953	These parameters determine the capacity of the existing building to withstand earthquake forces.		
Building Design Code	<1973 UBC			
Existing Building Code Level	Pre			
Geographic Area	Puget Sound			
Severe Vertical Irregularity	No	Buildings with irregularities have greater earthquake damage than otherwise similar buildings that are regular.		
Moderate Vertical Irregularity	No			
Plan Irregularity	Yes			
Seismic Data				
Earthquake Ground Shaking Hazard Level	High	Frequency and severity of earthquakes at this site		
Percentile S _s Among WA K-12 Campuses	37%	Earthquake ground shaking hazard is higher than 37% of WA campuses.		
Site Class (Soil or Rock Type)	D	Stiff Soil		
Liquefaction Potential	Moderate to High	Liquefaction increases the risk of major damage to a building		
Combined Earthquake Hazard Level	Very High	Earthquake ground shaking and liquefaction potential		
Severe Earthquake Event (Design Basis Earthquake Ground Motion) ¹				
Building State	Building Damage Estimate ²	Probability Building is not Repairable ³	Life Safety ⁴ Risk Level	Most Likely Post-Earthquake Tagging ⁵
Existing Building	73%	73%	Very High	Red
Life Safety Retrofit Building	14%	6.7%	Very Low	Green/Yellow
Current Code Building	11%	4.3%	Very Low	Green
1. 2/3rds of the 2% in 50 year ground motion		4. Based on probability of Complete Damage State.		
2. Percentage of building replacement value.		5. Most likely post-earthquake damage state per ATC-20.		
3. Probability building is in the Extensive or Complete damage states. For existing buildings, the probability that the building is not economically repairable may be higher: some buildings in the Moderate Damage state are also likely to be demolished.				
Source for the Data Entered into the Tool				
Building Evaluated By:	Kenny O'Neill & Suzie Bauer			
Person(s) Who Entered Data in EPAT:	Rami Sabra, Reid Middleton			
User Overrides of Default Parameters:	Building Design Code Year, Site Class, Liquefaction			

Washington Schools Earthquake Performance Assessment Tool (EPAT)				
RESULTS SUMMARY				
District Name	Burlington-Edison		Existing Building Life Safety Risk & Priority for Retrofit or Replacement	
School Name	Burlington-Edison High School			
Building Name	Fieldhouse 1984 Addition			
Low-Moderate				
Building Data				
HAZUS Building Type	RM1	Reinforced Masonry Bearing Walls w/ Wood or Metal Diaphragms		
Year Built	1984	These parameters determine the capacity of the existing building to withstand earthquake forces.		
Building Design Code	1976-1985 UBC			
Existing Building Code Level	Moderate			
Geographic Area	Puget Sound			
Severe Vertical Irregularity	No	Buildings with irregularities have greater earthquake damage than otherwise similar buildings that are regular.		
Moderate Vertical Irregularity	No			
Plan Irregularity	No			
Seismic Data				
Earthquake Ground Shaking Hazard Level	High	Frequency and severity of earthquakes at this site		
Percentile S _s Among WA K-12 Campuses	37%	Earthquake ground shaking hazard is higher than 37% of WA campuses.		
Site Class (Soil or Rock Type)	D	Stiff Soil		
Liquefaction Potential	Moderate to High	Liquefaction increases the risk of major damage to a building		
Combined Earthquake Hazard Level	Very High	Earthquake ground shaking and liquefaction potential		
Severe Earthquake Event (Design Basis Earthquake Ground Motion) ¹				
Building State	Building Damage Estimate ²	Probability Building is not Repairable ³	Life Safety ⁴ Risk Level	Most Likely Post-Earthquake Tagging ⁵
Existing Building	30%	25%	Low-Moderate	Yellow/Red
Life Safety Retrofit Building	14%	6.7%	Very Low	Green/Yellow
Current Code Building	11%	4.3%	Very Low	Green
1. 2/3rds of the 2% in 50 year ground motion		4. Based on probability of Complete Damage State.		
2. Percentage of building replacement value.		5. Most likely post-earthquake damage state per ATC-20.		
3. Probability building is in the Extensive or Complete damage states. For existing buildings, the probability that the building is not economically repairable may be higher: some buildings in the Moderate Damage state are also likely to be demolished.				
Source for the Data Entered into the Tool				
Building Evaluated By:	Kenny O'Neill & Suzie Bauer			
Person(s) Who Entered Data in EPAT:	Rami Sabra, Reid Middleton			
User Overrides of Default Parameters:	Building Design Code Year, Site Class, Liquefaction			

Appendix E: Burlington-Edison High School Gym/Fieldhouse Existing Drawings

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APPROVED
DATE 9/28/53

Dean Kelly
Thos. V. Laidlaw

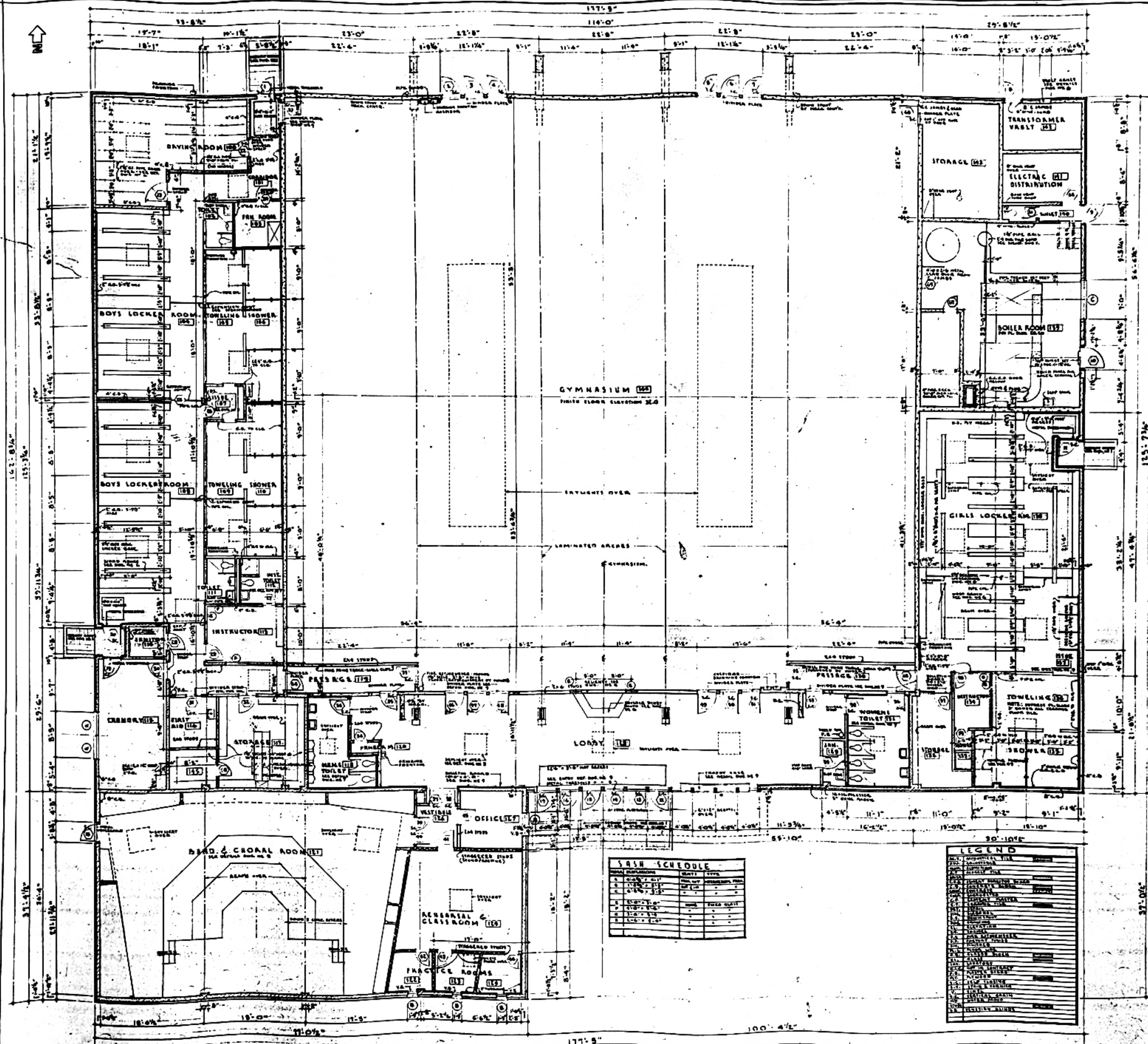
PLANNED
PLOT PLAN
SCALE

BURLINGTON - EDISON
HIGH SCHOOL PHYSICAL
EDUCATION BUILDING
BURLINGTON, VERMONT
GAIL BENTLEY, ARCHITECT

Sheet No. 1

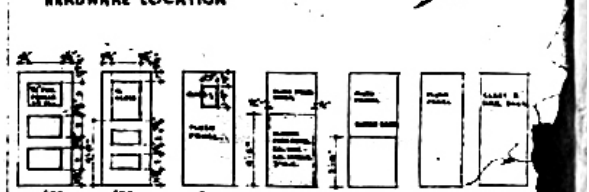
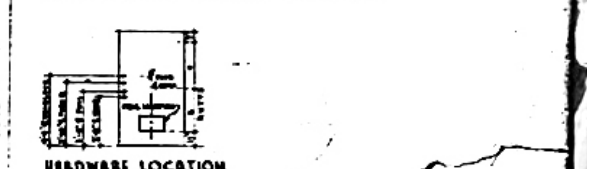
275

GALEN W. BENTLEY - ARCHITECT
213 LUTHER BUILDING - BELLINGHAM, WASHINGTON



ROOM SCHEDULE

ROOM NO.	NAME OF ROOM	FLOOR	DOOR	WALL	CEILING	TYPE OF FLOOR	TYPE OF WALL	TYPE OF CEILING	TYPE OF LIGHTING	TYPE OF HEATING	TYPE OF VENTILATION	TYPE OF SOUNDING	TYPE OF OTHER
100	GYMNASIUM	1	100	100	100	100	100	100	100	100	100	100	100
101	BOYS LOCKER ROOM	1	101	101	101	101	101	101	101	101	101	101	101
102	BOYS LOCKER ROOM	1	102	102	102	102	102	102	102	102	102	102	102
103	BOYS LOCKER ROOM	1	103	103	103	103	103	103	103	103	103	103	103
104	GIRLS LOCKER ROOM	1	104	104	104	104	104	104	104	104	104	104	104
105	GIRLS LOCKER ROOM	1	105	105	105	105	105	105	105	105	105	105	105
106	REST & CROCK ROOM	1	106	106	106	106	106	106	106	106	106	106	106
107	RECREATION CLASSROOM	1	107	107	107	107	107	107	107	107	107	107	107
108	PRACTICE ROOM	1	108	108	108	108	108	108	108	108	108	108	108
109	PRACTICE ROOM	1	109	109	109	109	109	109	109	109	109	109	109
110	PRACTICE ROOM	1	110	110	110	110	110	110	110	110	110	110	110
111	INSTRUCTOR	1	111	111	111	111	111	111	111	111	111	111	111
112	STORAGE	1	112	112	112	112	112	112	112	112	112	112	112
113	BOILER ROOM	1	113	113	113	113	113	113	113	113	113	113	113
114	TOILET	1	114	114	114	114	114	114	114	114	114	114	114
115	TOILET	1	115	115	115	115	115	115	115	115	115	115	115
116	TOILET	1	116	116	116	116	116	116	116	116	116	116	116
117	TOILET	1	117	117	117	117	117	117	117	117	117	117	117
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120	TOILET	1	120	120	120	120	120	120	120	120	120	120	120
121	TOILET	1	121	121	121	121	121	121	121	121	121	121	121
122	TOILET	1	122	122	122	122	122	122	122	122	122	122	122
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127	TOILET	1	127	127	127	127	127	127	127	127	127	127	127
128	TOILET	1	128	128	128	128	128	128	128	128	128	128	128
129	TOILET	1	129	129	129	129	129	129	129	129	129	129	129
130	TOILET	1	130	130	130	130	130	130	130	130	130	130	130
131	TOILET	1	131	131	131	131	131	131	131	131	131	131	131
132	TOILET	1	132	132	132	132	132	132	132	132	132	132	132
133	TOILET	1	133	133	133	133	133	133	133	133	133	133	133
134	TOILET	1	134	134	134	134	134	134	134	134	134	134	134
135	TOILET	1	135	135	135	135	135	135	135	135	135	135	135



DOOR SCHEDULE

DOOR NO.	NAME OF DOOR	FLOOR	DOOR	WALL	CEILING	TYPE OF FLOOR	TYPE OF WALL	TYPE OF CEILING	TYPE OF LIGHTING	TYPE OF HEATING	TYPE OF VENTILATION	TYPE OF SOUNDING	TYPE OF OTHER
100	GYMNASIUM	1	100	100	100	100	100	100	100	100	100	100	100
101	BOYS LOCKER ROOM	1	101	101	101	101	101	101	101	101	101	101	101
102	BOYS LOCKER ROOM	1	102	102	102	102	102	102	102	102	102	102	102
103	BOYS LOCKER ROOM	1	103	103	103	103	103	103	103	103	103	103	103
104	GIRLS LOCKER ROOM	1	104	104	104	104	104	104	104	104	104	104	104
105	GIRLS LOCKER ROOM	1	105	105	105	105	105	105	105	105	105	105	105
106	REST & CROCK ROOM	1	106	106	106	106	106	106	106	106	106	106	106
107	RECREATION CLASSROOM	1	107	107	107	107	107	107	107	107	107	107	107
108	PRACTICE ROOM	1	108	108	108	108	108	108	108	108	108	108	108
109	PRACTICE ROOM	1	109	109	109	109	109	109	109	109	109	109	109
110	PRACTICE ROOM	1	110	110	110	110	110	110	110	110	110	110	110
111	INSTRUCTOR	1	111	111	111	111	111	111	111	111	111	111	111
112	STORAGE	1	112	112	112	112	112	112	112	112	112	112	112
113	BOILER ROOM	1	113	113	113	113	113	113	113	113	113	113	113
114	TOILET	1	114	114	114	114	114	114	114	114	114	114	114
115	TOILET	1	115	115	115	115	115	115	115	115	115	115	115
116	TOILET	1	116	116	116	116	116	116	116	116	116	116	116
117	TOILET	1	117	117	117	117	117	117	117	117	117	117	117
118	TOILET	1	118	118	118	118	118	118	118	118	118	118	118
119	TOILET	1	119	119	119	119	119	119	119	119	119	119	119
120	TOILET	1	120	120	120	120	120	120	120	120	120	120	120
121	TOILET	1	121	121	121	121	121	121	121	121	121	121	121
122	TOILET	1	122	122	122	122	122	122	122	122	122	122	122
123	TOILET	1	123	123	123	123	123	123	123	123	123	123	123
124	TOILET	1	124	124	124	124	124	124	124	124	124	124	124
125	TOILET	1	125	125	125	125	125	125	125	125	125	125	125
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128	TOILET	1	128	128	128	128	128	128	128	128	128	128	128
129	TOILET	1	129	129	129	129	129	129	129	129	129	129	129
130	TOILET	1	130	130	130	130	130	130	130	130	130	130	130
131	TOILET	1	131	131	131	131	131	131	131	131	131	131	131
132	TOILET	1	132	132	132	132	132	132	132	132	132	132	132
133	TOILET	1	133	133	133	133	133	133	133	133	133	133	133
134	TOILET	1	134	134	134	134	134	134	134	134	134	134	134
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APPROVED

DATE 4/24/53

GLEN W. BENTLEY ARCHITECT

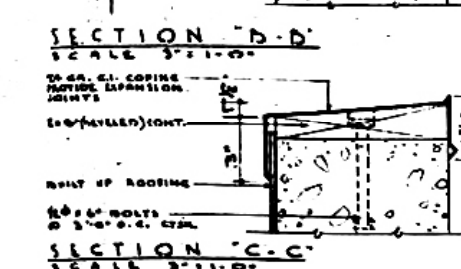
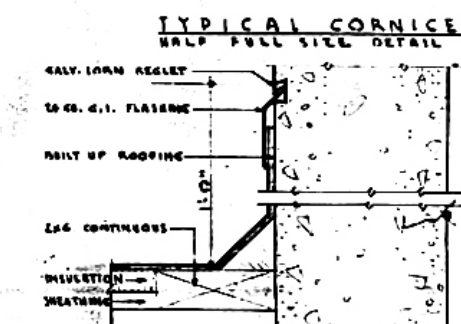
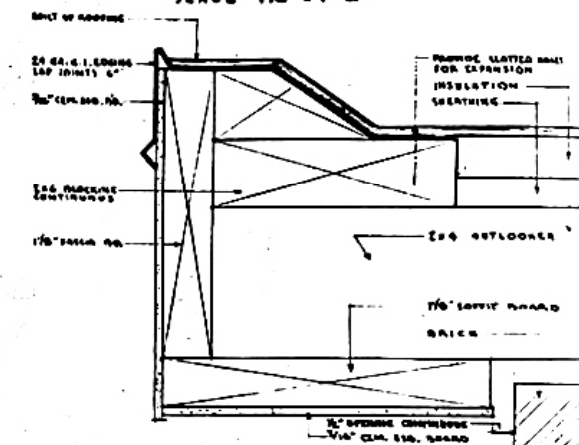
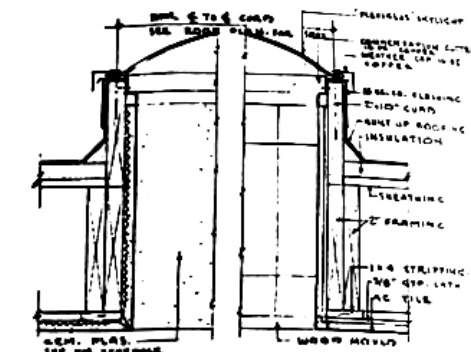
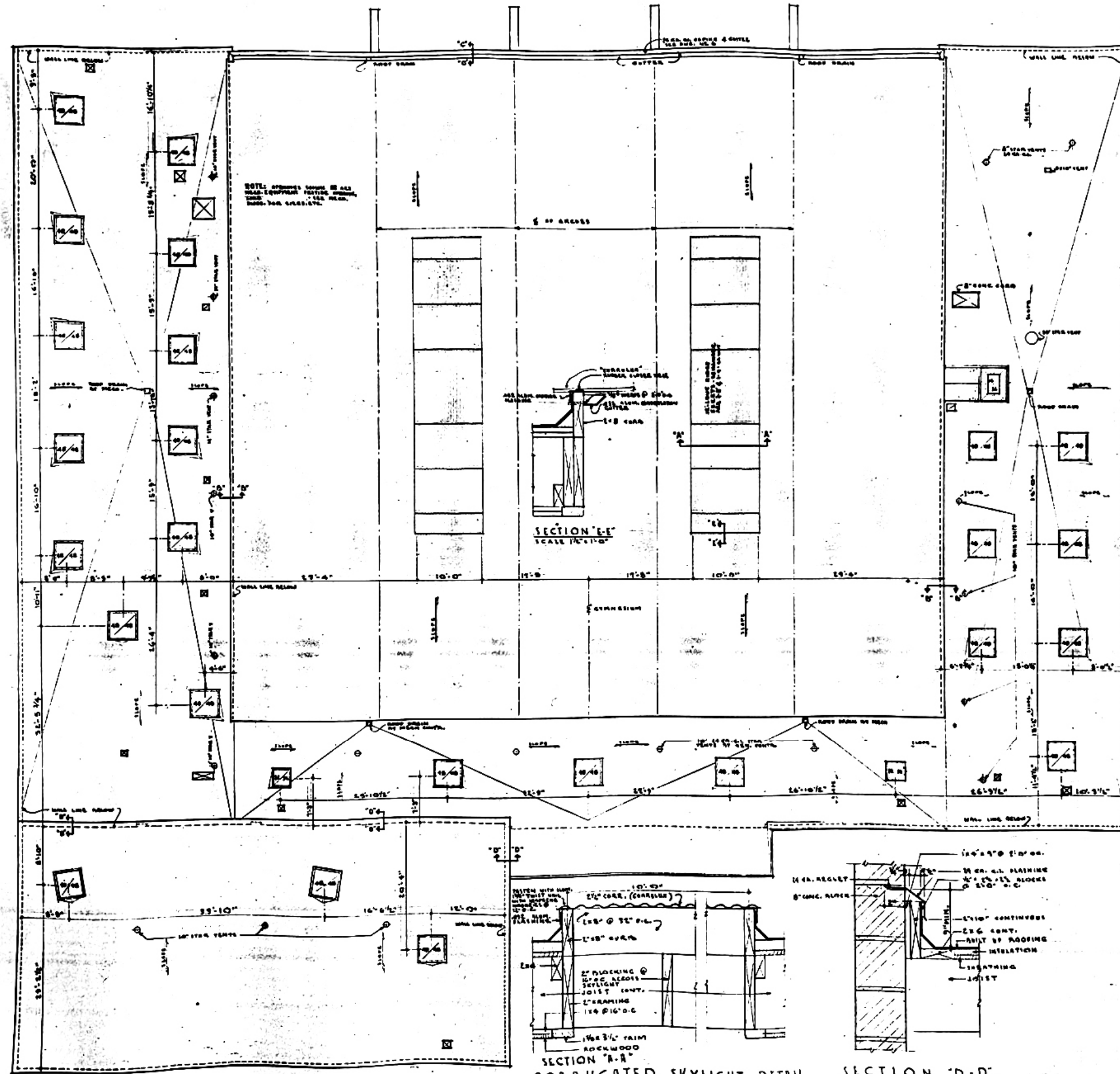
213 LUTHER BUILDING - BELLINGHAM, WASH.

BURLINGTON-EDISON HIGH SCHOOL PHYSICAL EDUCATION BUILDING

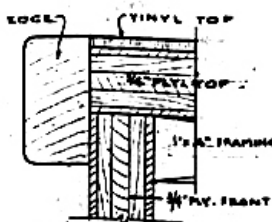
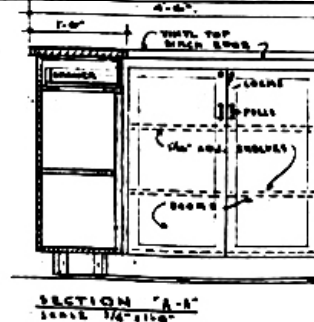
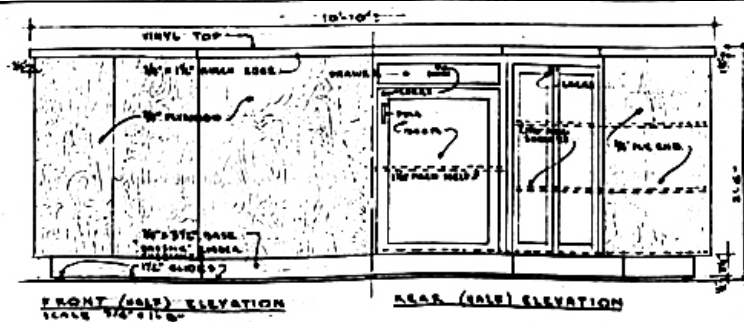
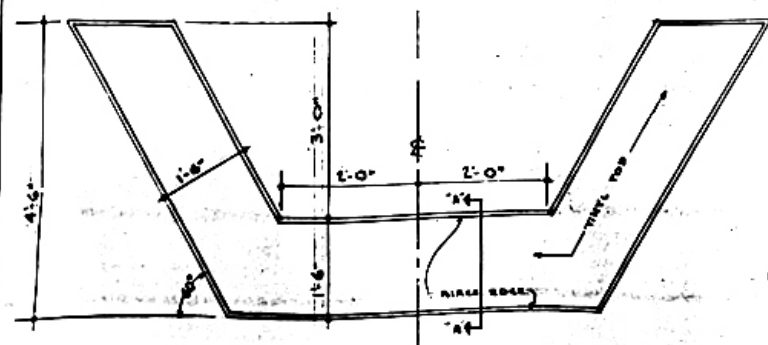
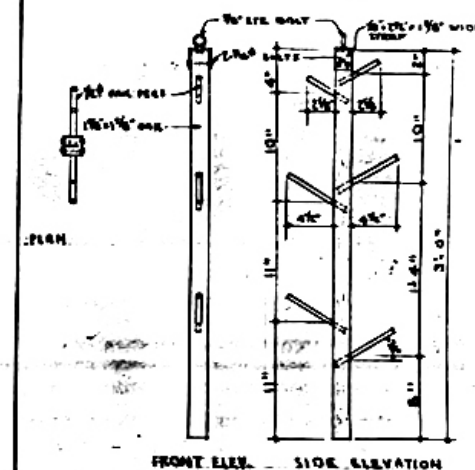
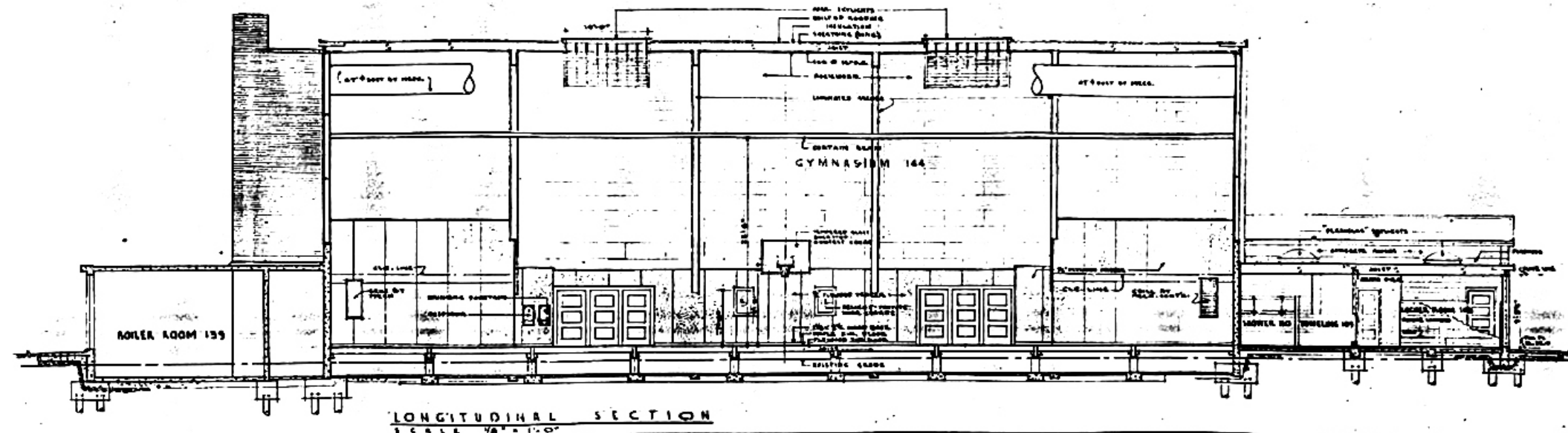
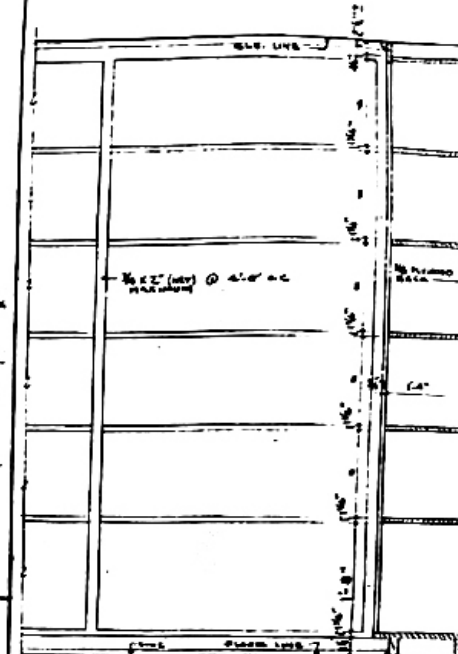
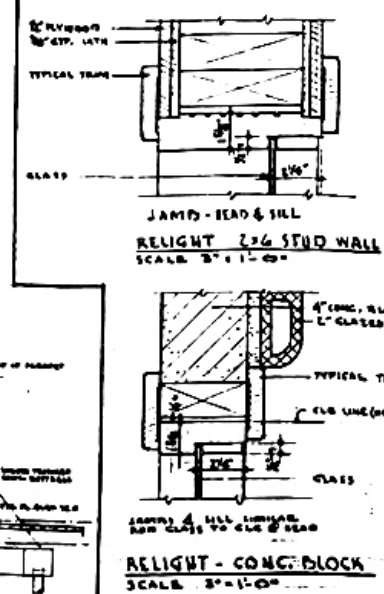
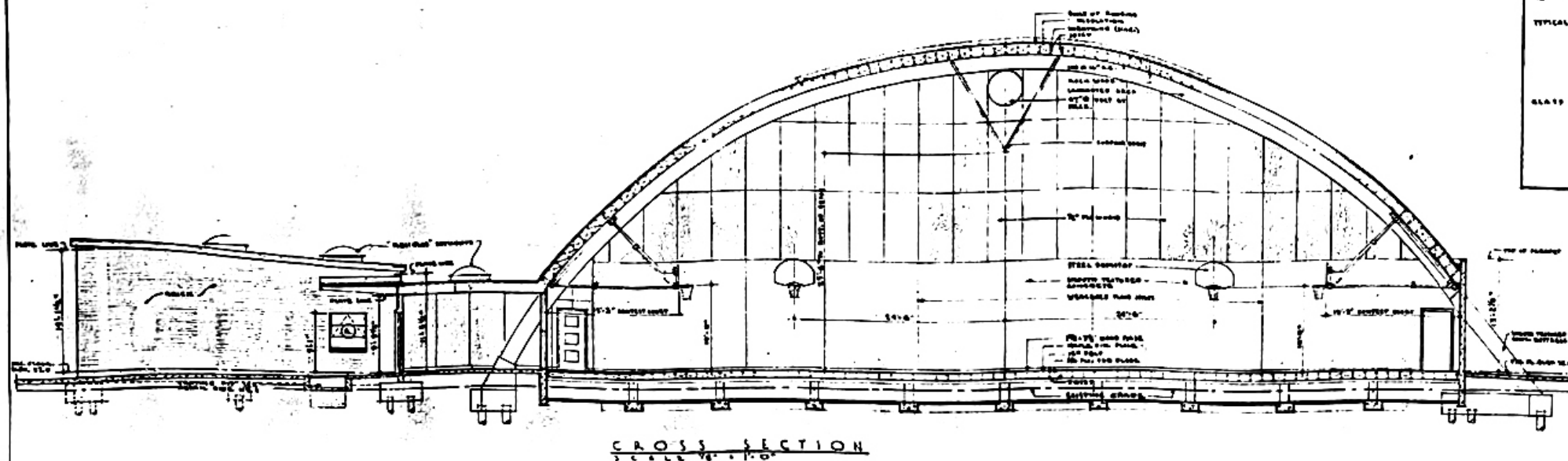
BURLINGTON-EDISON SCHOOL DISTRICT


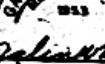
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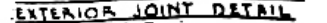
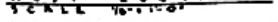
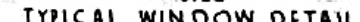
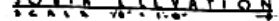
SHEET NO. 2

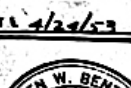


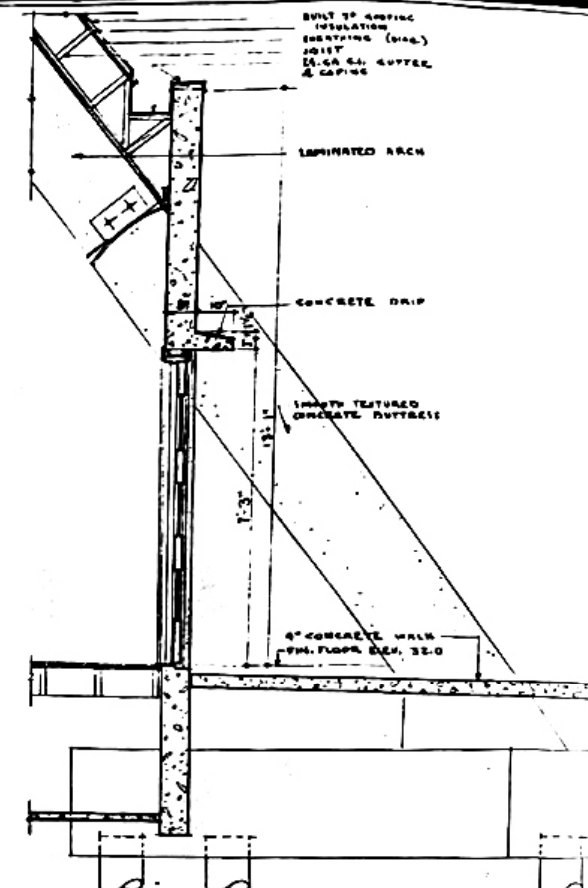
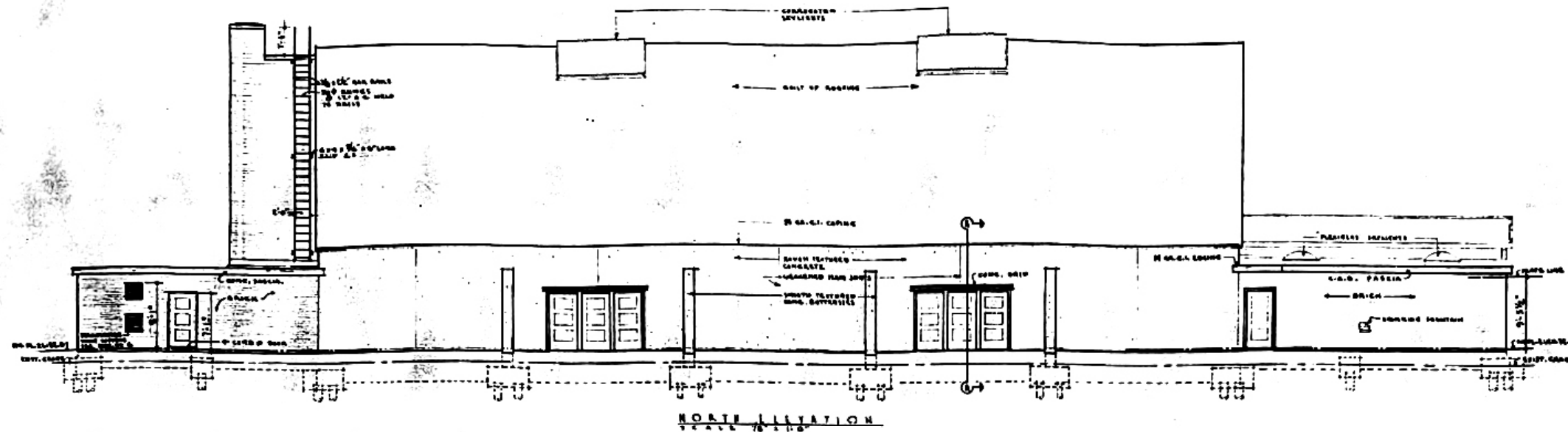
APPROVED		DATE 4/24/53	
GALLEN W. BENTLEY ARCHITECT		213 LUTHER BUILDING - BELLINGHAM, WASHINGTON - PHONE 5918	
ROOF PLAN SCALE 1/2" = 1'-0"		BURLINGTON-EDISON HIGH SCHOOL PHYSICAL EDUCATION BUILDING BURLINGTON-EDISON SCHOOL DISTRICT NO. 100 BELLINGHAM, WASHINGTON	
SHEET NO. 5		JOB NO. 273	



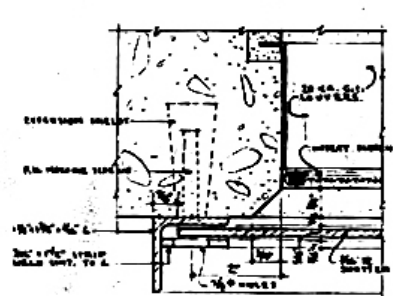
APPROVED	<i>Wesley D. [illegible]</i>
DATE 4/24/53	<i>Wesley D. [illegible]</i>
	SECTIONS
	SCALE AS NOTED
	BURLINGTON - EDISON HIGH SCHOOL PHYSICAL EDUCATION BUILDING BURLINGTON - EDISON SCHOOL, DISTRICT NO. 1 BURLINGTON, WASHINGTON
	SHEET NO. <u>4</u>
	JOB NO. <u>273</u>
GALEN W. BENTLEY - ARCHITECT 213 LUTHER BUILDING - BELLINGHAM, WASHINGTON - PHONE 5	



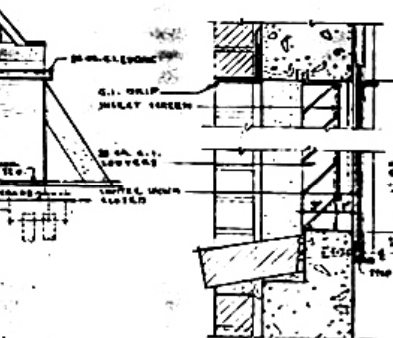
APPROVED _____	PERMIT NO. 1000
DATE 4/24/53	THRU 7/1/53
	SOUTH WEST ELEVATIONS
	SCALE 3/4" = 1'-0"
	BRUNTINGTON - EDISON HIGH SCHOOL PHYSICAL EDUCATION BUILDING
	COLLEKTION EDISON - EDISON, DISTRICT NO. 100 BRUNTINGTON, WASHINGTON
DRAWN BY _____	JOB NO. 275



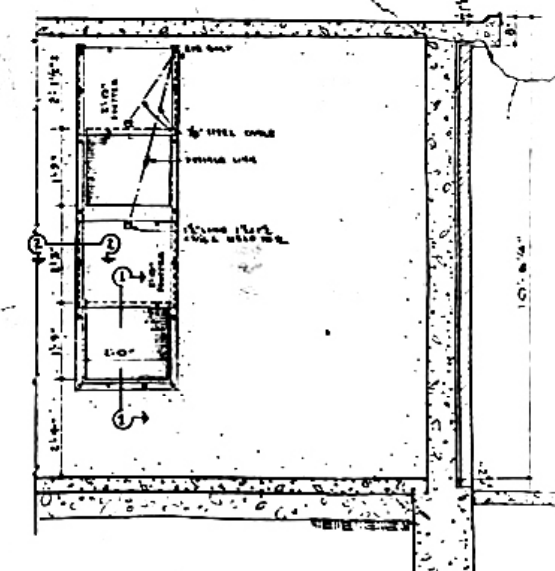
SECTION A-A
SCALE 1/2" = 1'-0"



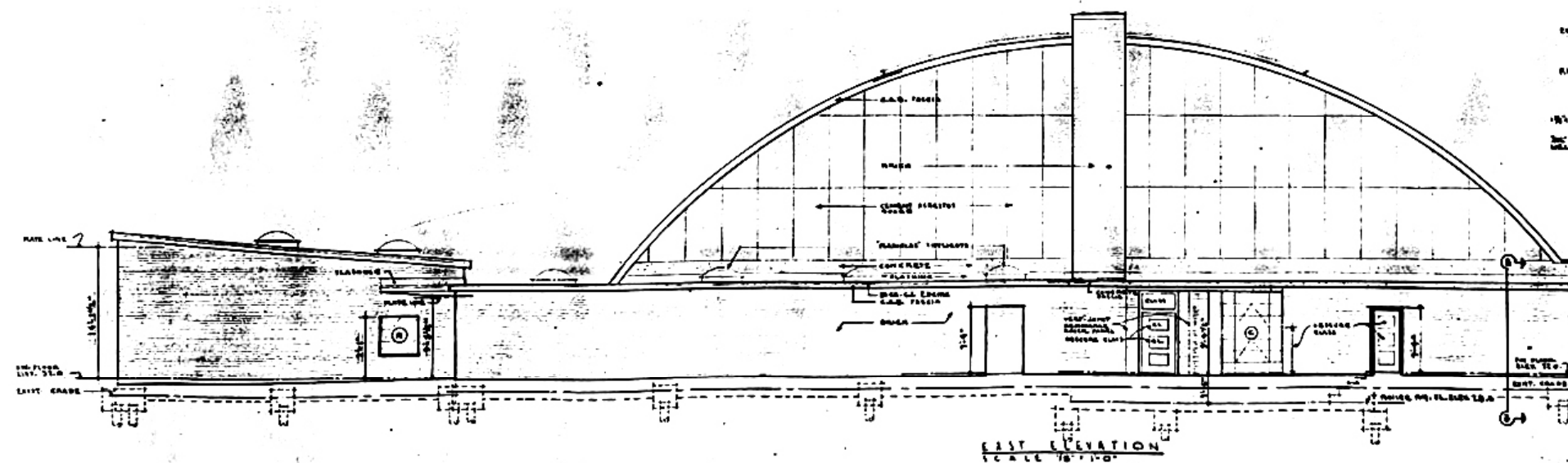
SECTION 2-2
HALF FULL SIZE DETAIL



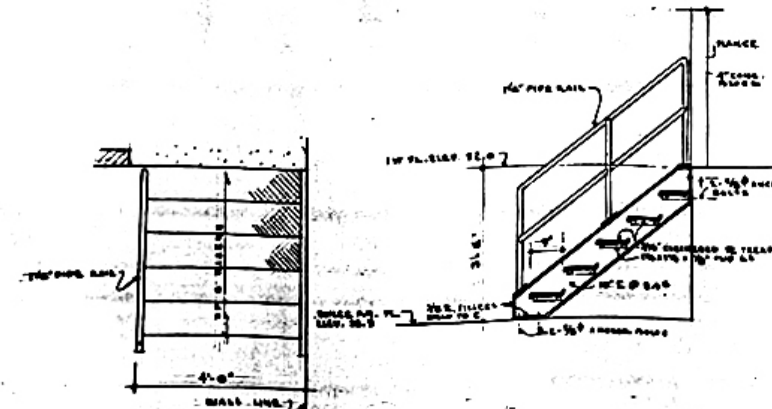
SECTION 1-1
SCALE 1/4" = 1'-0"
TRANSFORMER VAULT VENT GRILLS



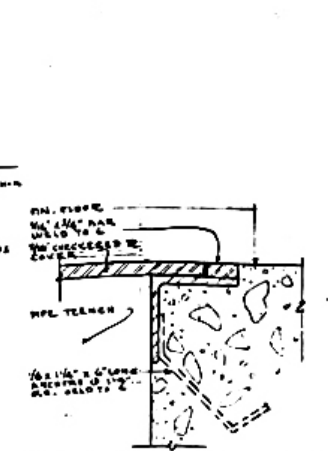
SECTION B-B
SCALE 1/2" = 1'-0"



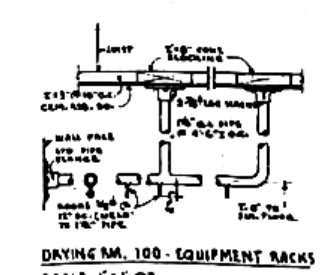
EAST ELEVATION
SCALE 1/2" = 1'-0"



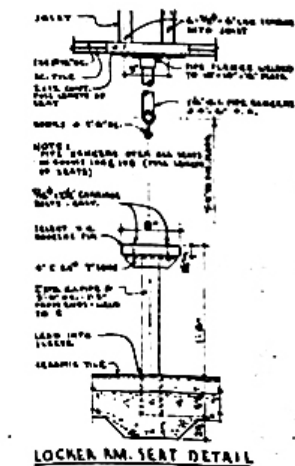
PLAN
SECTION
STEEL STAIR DETAIL RM. 139
SCALE 1/2" = 1'-0"



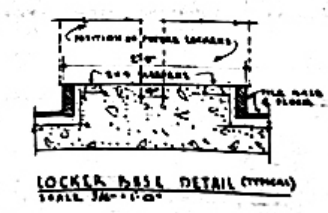
PIPE TRENCH COVER & FRAME
RM. 139 SCALE 1/2" = 1'-0"



DRYING RM. 100 - EQUIPMENT RACKS
SCALE 1/2" = 1'-0"

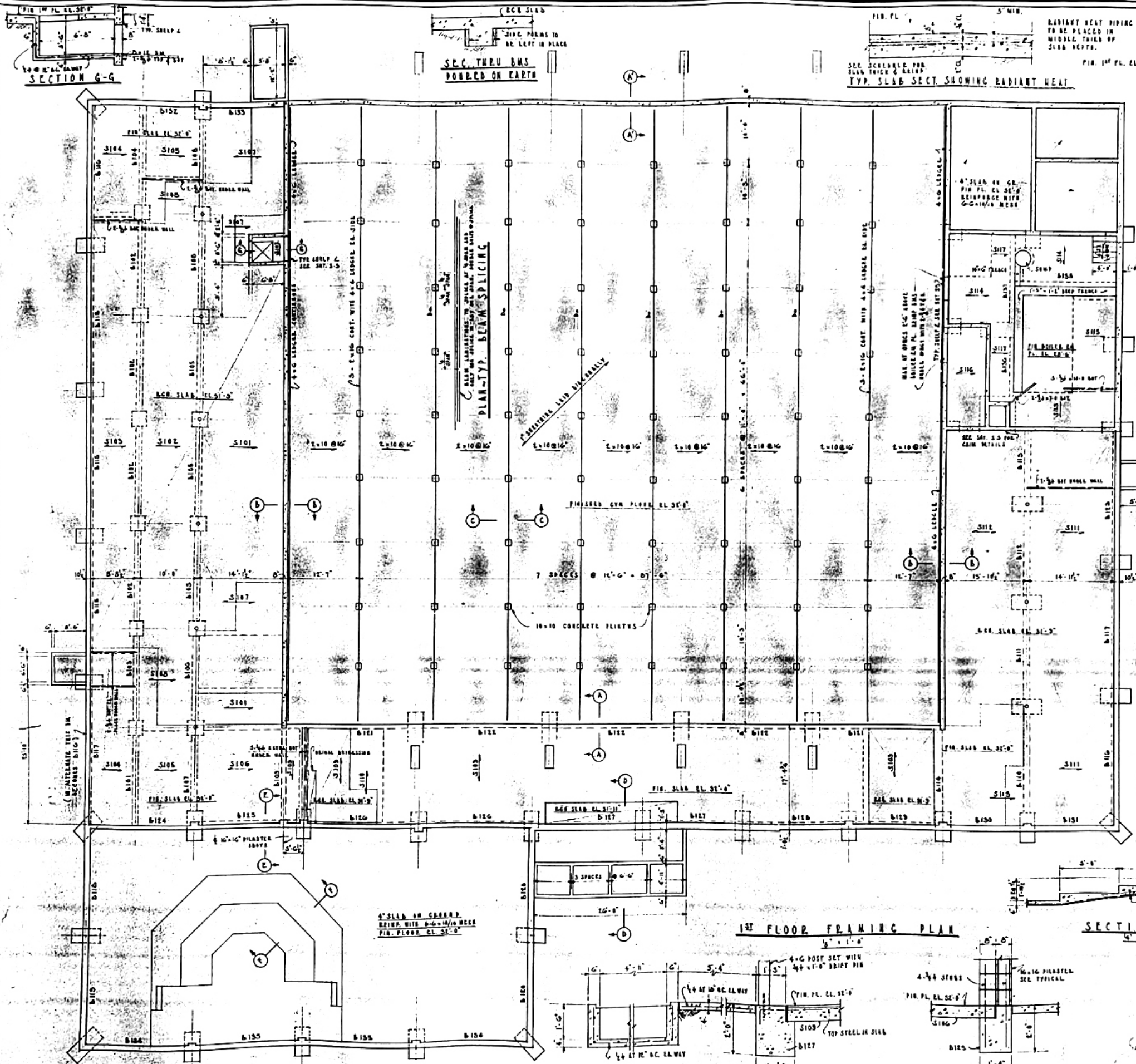


LOCKER RM. SEAT DETAIL
SCALE 1/2" = 1'-0"



LOCKER BASE DETAIL (TYPICAL)
SCALE 1/2" = 1'-0"

APPROVED		DATE 4/24/53	
		NORTH & EAST ELEVATIONS SCALE 1/2" = 1'-0" BERLINGTON-EDISON HIGH SCHOOL PHYSICAL EDUCATION BUILDING WASHINGTON-EDISON SCHOOL DISTRICT NO. 140 WASHINGTON, WASHINGTON SHEET NO. 6 JOB NO. 273	
GALEN W. BENTLEY - ARCHITECT 213 LUTHER BUILDING - BELLINGHAM, WASH.			



S.C. THRU RMS
POURED ON EARTH

SEC. SLAB SECTION
TYP. SLAB SECTION SHOWING RADIANT HEAT

SECTION A-A
SEC. A-A SIMILAR

SECTION B-B

TYP. PIPE COLUMN
BASE DETAIL

TYP. SLAB DEPRESSION

TYPICAL SECTION
PIPE TRENCH

TYP. ENTRANCE SECTION

TYP. SEC. - MUSIC RM

SECTION C-C
TYPICAL

TYPICAL EXT. WALL
BEAM - LOCKER-RMS
LOBBY BEAMS SIMILAR

TYP. EXT. WALL SEC.
BOILER RM STOP, C. VAULT

1ST FLOOR FRAMING PLAN

SECTION F-F

SECTION D-D

SECTION E-E

APPROVED
DATE 4/1/53

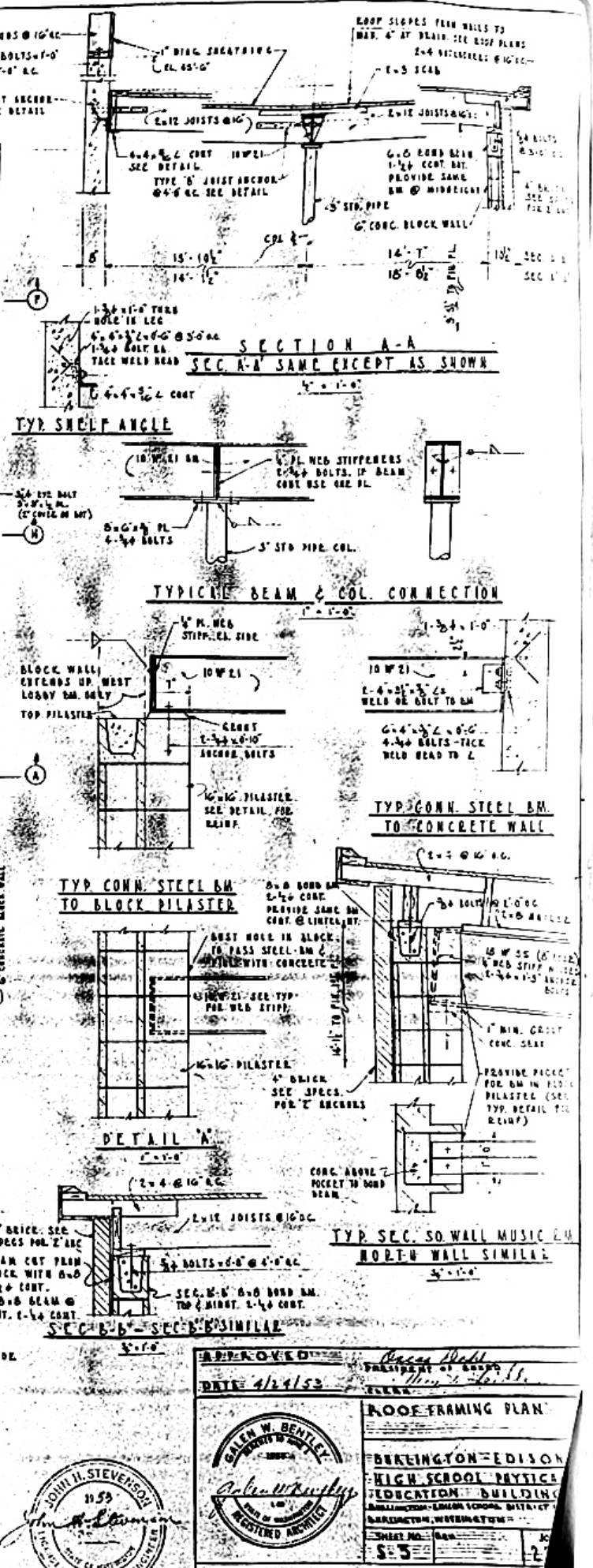
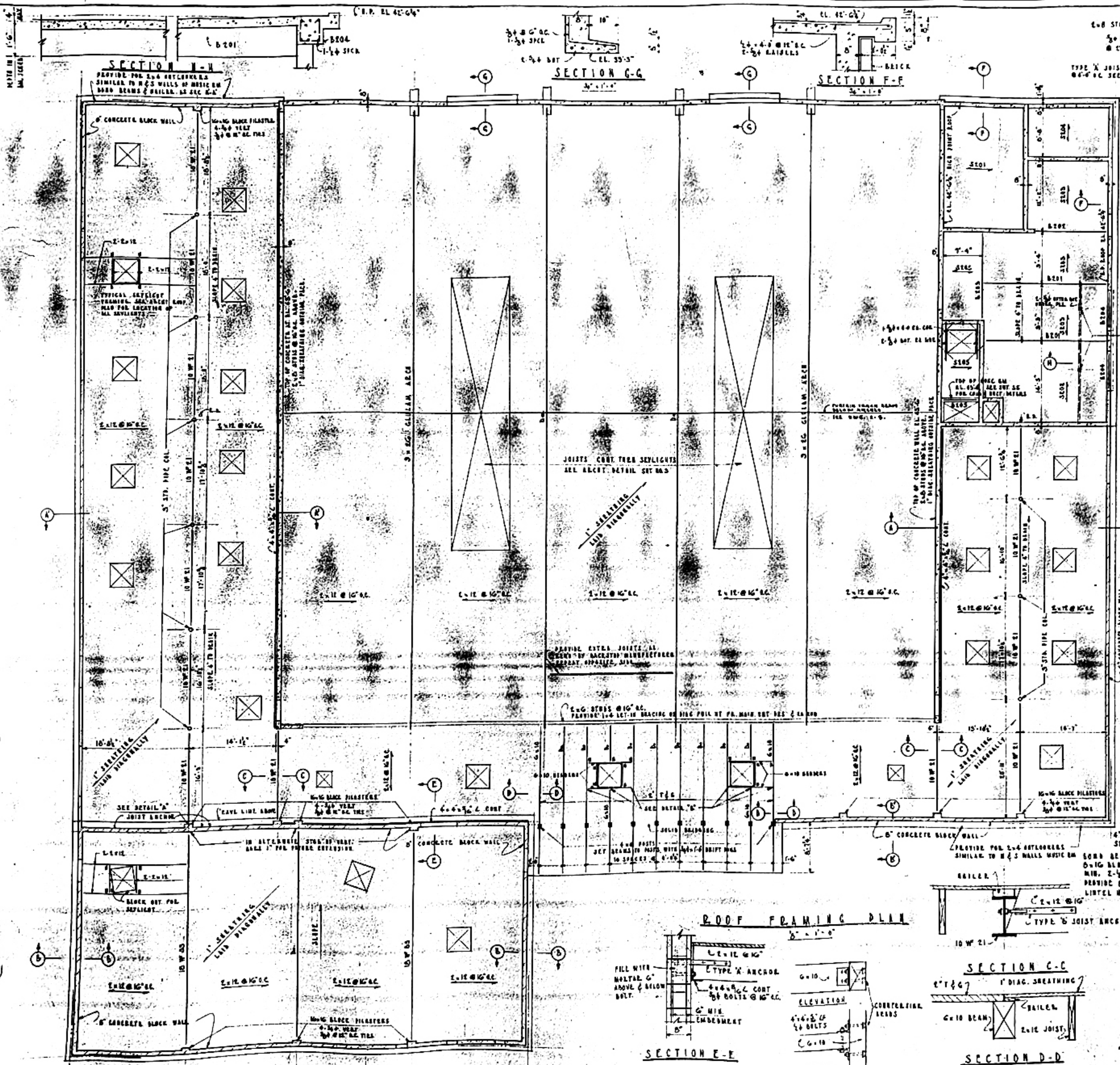
GALEN W. BENTLEY
213 LUTHER BUILDING - BELLINGHAM, WASHINGTON - PHONE 5918

1ST FLOOR FRAMING PLAN

BURLINGTON-EDISON
HIGH SCHOOL PHYSICAL
EDUCATION BUILDING
BURLINGTON-EDISON SCHOOL DISTRICT NEUM.
BURLINGTON, WASHINGTON

SHEET NO. 5-2

JOB NO. 273



APPROVED
DATE 4/24/52

GALEN W. BENTLEY ARCHITECT
213 LUTHER BUILDING - BELLINGHAM, WASHINGTON, P.O.

ROOF FRAMING PLAN
BELLINGTON-EDISON
HIGH SCHOOL PHYSICS
EDUCATION BUILDING
BELLINGTON-EDISON SCHOOL DISTRICT
BELLINGTON, WASHINGTON
SHEET NO. 1
S.S.

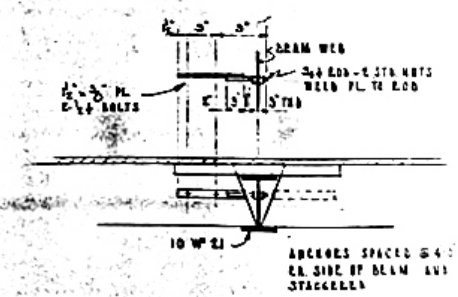
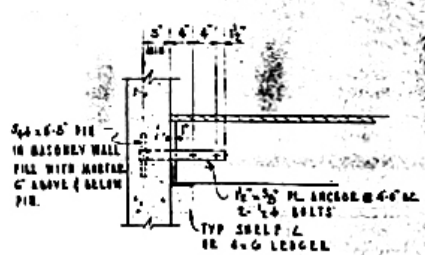
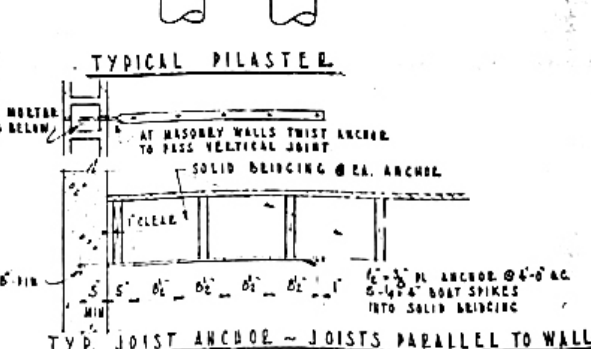
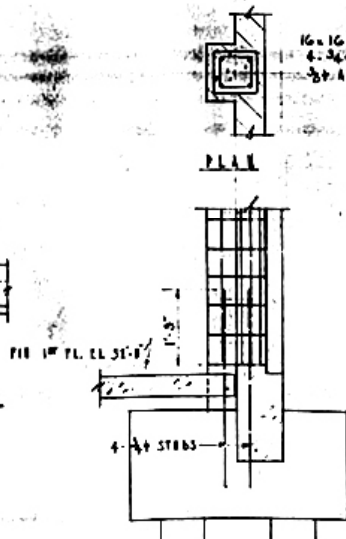
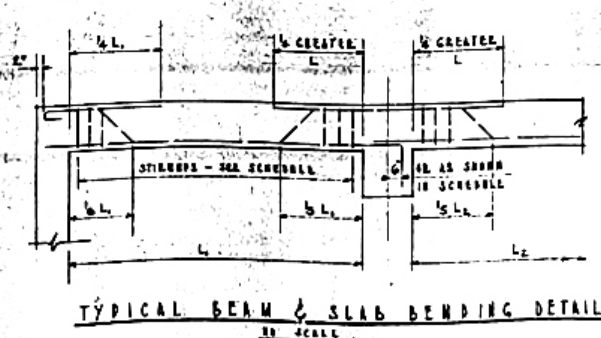
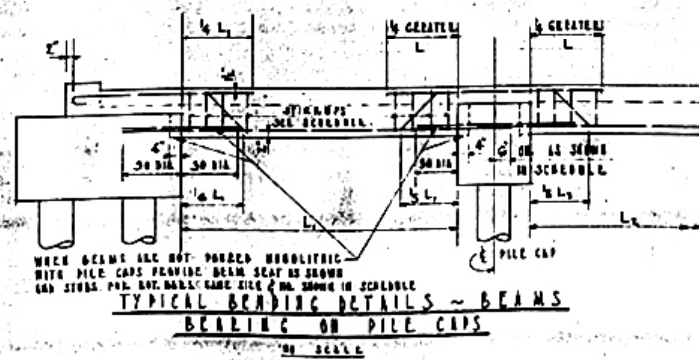
TEAM NAME	SIZE		NO	E L I P O R C I R G			REARRANGEMENT	REMARKS
	W	D		SIZE	DATE	LGTH		
B101	12	15	2	24			TOP TOP BOT STIR	
B102	12	15	1	10			TOP TOP BOT BOT STIR E.E.	
B103	12	15/10	1	10			TOP TOP @ BIRD E.E. BOT STIR	
B104	12	15	2	24			TOP TOP BOT BOT STIR	
B105	12	15	1	10			TOP TOP BOT BOT STIR E.E.	
B106	12	15	1	10			TOP BOT BOT STIR E.E.	
B107	12	15	2	24			TOP TOP BOT BOT STIR	
B108	12	15/10	2	24			TOP TOP BOT STIR	
B109	8	15	2	24			TOP @ WALL TOP BOT STIR E.E.	
B110	12	15	2	24			TOP TOP BOT BOT STIR	
B111	12	15	1	10			TOP TOP @ BIRD BOT BOT STIR E.E.	
B112	12	15	2	24			TOP @ BIRD BOT BOT STIR E.E.	
B113	12	15	2	24			TOP BOT BOT STIR	
B114	16	15	2	24			TOP TOP BOT BOT STIR E.E.	
B115	10 1/2	17 1/4	2	24	14-6		TOP (SEE TOP BOT BOT STIR (5	
B116	10 1/2	17 1/4	2	24	15-3		TOP (SEE TOP BOT BOT STIR (5	
B117	10 1/2	17 1/4	2	24	14-0		TOP @ BIRD & B113 TOP BOT BOT STIR (5 (SEE DETAIL)	
B118	12 1/2	24	2	24	11-3		TOP BOT STIR (5	
B119	12 1/2	24	2	24	9-3		TOP TOP BOT BOT STIR (5	
B120	12 1/2	24	2	24	11-0		TOP TOP TOP BOT STIR (5	
B121	8	40	2	24	13-0		TOP TOP TOP SIDE BARS BOT STIR (5 (SEE DETAIL)	
B122	8	40	2	24	13-6		TOP TOP TOP SIDE BARS BOT STIR (5	
B123	10 1/2	17 1/4	2	24	14-4		TOP (SEE TOP @ WALL (SEE TOP BOT BOT STIR (5 (SEE DETAIL)	
B124	8	24	2	24	11-3		TOP TOP TOP BOT STIR (5	
B125	8 1/2	18 1/4	2	24	10-3		TOP @ BIRD (SEE TOP BOT BOT STIR (5 (SEE DETAIL)	
B126	8 1/2	18 1/4	2	24	12-0		TOP (SEE PLAN FOR TOP BOT BOT STIR E.E. (5	

BRAM MARK	SIZE		R E I F P O R C I N G		ALIGNMENT	REMARKS
	W	D	RO	SIZE		
B127	15/19 1/2	16/14	2 2 2	1" 3/4" 3/4"	10-5	TOP TOP BOT STIE (SEE DETAIL)
B128	12 1/2	16/14	2 2 2	1" 3/4" 3/4"	10-3	TOP TOP BOT STIE (SEE DETAIL)
B129	11 1/2	15/14	2 2 2	1" 3/4" 3/4"	10-3	TOP TOP BOT STIE (SEE DETAIL)
B130	12 1/2	14	2 2 2	1" 3/4" 3/4"		TOP TOP BOT STIE
B131	12 1/2	14	2 2 2	1" 3/4" 3/4"		TOP TOP BOT STIE
B132	10 1/2	14	2 2 2	1" 3/4" 3/4"	11-3	TOP TOP TOP BOT STIE
B133	10 1/2	14	2 2 2	1" 3/4" 3/4"	10-0	TOP & WALL TOP BOT STIE
B134	12 1/2	36	2 2 2	1" 3/4" 3/4"	10-6	TOP TOP TOP BOT STIE
B135	12 1/2	36	1 1 2	1" 1" 3/4"	10-0	TOP TOP TOP BOT STIE
B136	8	20	1 1 1	3/4" 3/4" 3/4"		BOT STIE E.E.
B137	10	20	1 1 1	1" 1" 3/4"		BOT STIE
B138	10	14/20	1 1 1	1" 1" 3/4"		RT. ANGLE BOLT & WALL BOT STIE
B201	12	16	1 1 1	1" 1" 3/4"		BOT BOT BOT STIE E.E.
B202	8	16	1 1 1	3/4" 3/4" 3/4"		BOT STIE E.E.
B203	12	16	1 1 1	1" 1" 3/4"		BOT STIE E.E.
B204	15	15	2 2 2	3/4" 3/4" 3/4"		TOP (SEE DETAIL) BOT (IN & WALL) STIE
B205	8	18	2 2 2	3/4" 3/4" 3/4"		TOP BOT BOT STIE E.E.

SLAB MARK	SLAB THICK	STEEL SIZE	SPAC	LOADING & REMARKS
S101	6"	$\frac{1}{2}$ " $\frac{3}{8}$ " $\frac{1}{4}$ "	12 12 12	TOP TOP BOT
S102	6"	$\frac{3}{8}$ "	3	BOT
S103	6"	$\frac{3}{8}$ "	12 12 12	TOP TOP BOT
S104	6"	$\frac{3}{8}$ "	12 12 12	TOP TOP BOT
S105	6"	$\frac{3}{8}$ "	12	BOT
S106	6"	$\frac{1}{2}$ "	3 12 6	TOP @ 3105 TOP BOT
S107	6" 5'			SAME AS S101
S108	6" 5'			SAME AS S102
S109	6"	$\frac{1}{2}$ " $\frac{3}{8}$ " $\frac{1}{4}$ "	12 12 12	TOP TOP BOT
S110	6" 11'			SAME AS S109
S111	6"	$\frac{1}{2}$ "	12 12 12	TOP TOP BOT
S112	6"	$\frac{3}{8}$ "	12 12	TOP BOT
S113	6" 10"	$\frac{3}{8}$ "	12 12	TOP BOT
S114	6"	$\frac{1}{2}$ "	12 12 12	TOP TOP BOT
S115	6"	$\frac{1}{2}$ "	12 12 12	TOP TOP BOT
S116	6"	$\frac{1}{2}$ "	12 12	TOP @ 6" WALL BOT
S117	6"	$\frac{1}{2}$ "	12	BOT
S201	5"	$\frac{1}{2}$ " $\frac{3}{8}$ " $\frac{1}{4}$ "	12 12 3	TOP TOP BOT
S202	4"	$\frac{1}{2}$ "	12 12 12	TOP TOP BOT
S203	4"	$\frac{3}{8}$ "	7	TOP BOT
S204	4"	$\frac{1}{2}$ " $\frac{3}{8}$ "	12 7	TOP BOT
S205	4"	$\frac{1}{2}$ " $\frac{3}{8}$ " $\frac{1}{4}$ "	12 12 3	TOP TOP BOT

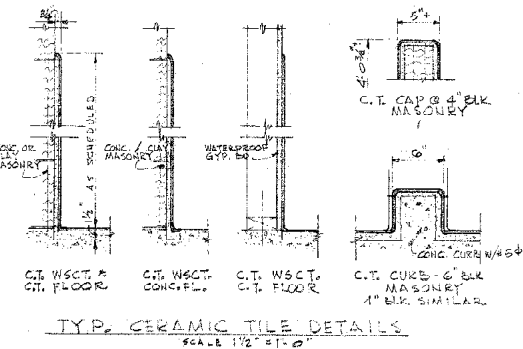
THE FOLLOWING NOTES APPLY, EXCEPT WHERE STEELWORK SPECIFIED

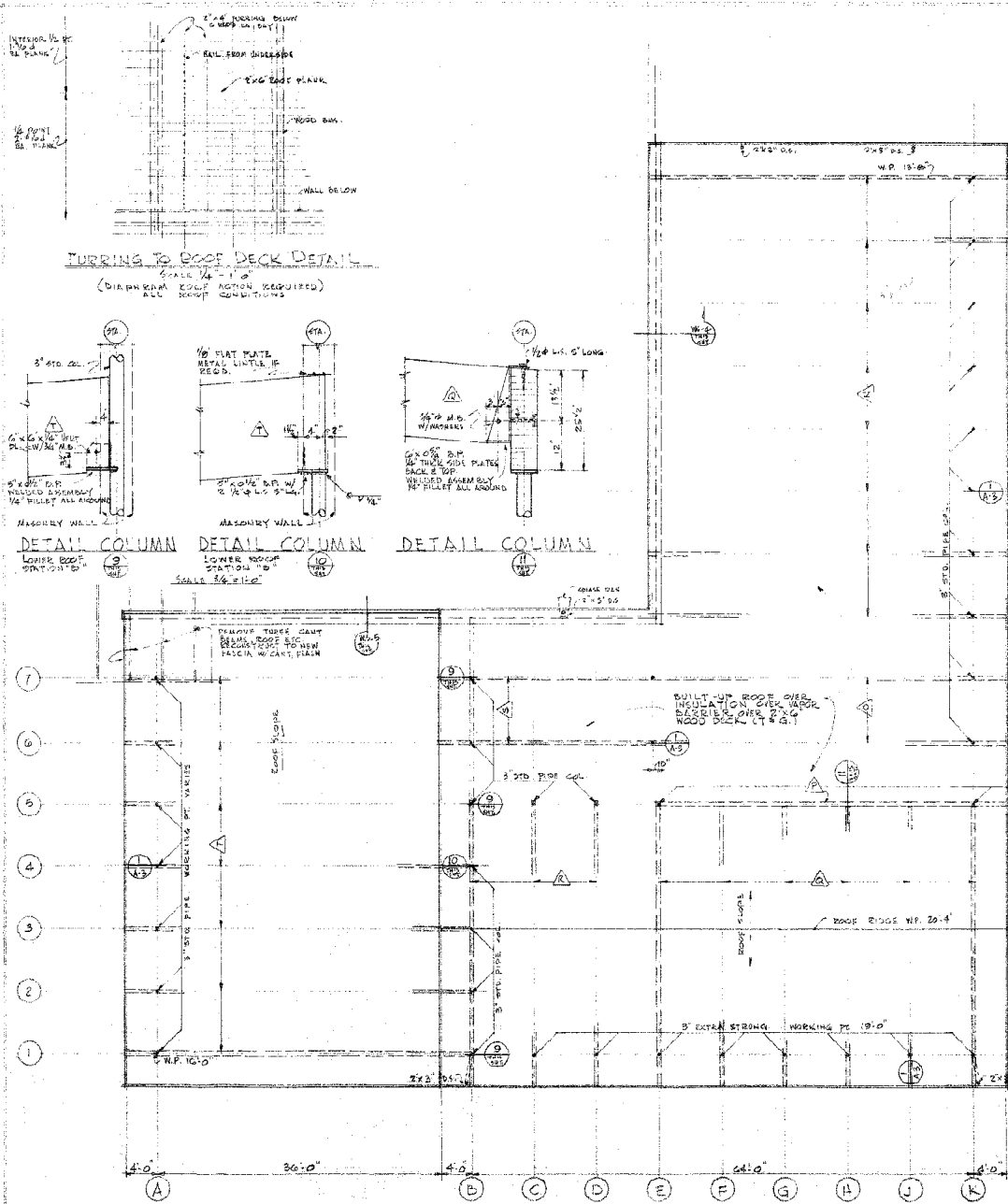
CODE	PACIFIC COAST UNIFORM BUILDING CODE (1952 EDITION)	
LIVE LOADS	ROOF 25 % LOBBY 100 LOCKER ROOMS 50 CYMRASIUM 100 FIN ROOM & BOILER ROOM 75 TOILETS 50 SEISMIC ZONE 3 HORIZONTAL FORCE FACTORS	
PLING	ALL PILES TO BE CROSS-SECTION DOUGLAS FIR ACCORDING TO SPECIFICATIONS, ALL TO BE DRIVEN TO A BEARING VALUE OF 30 TONS AS DETERMINED FROM THE LATEST NEWS RECORDS, PORTLAND.	
CONCRETE	ALL CONCRETE CONSTRUCTION EXCEPT NON-STRUCTURAL SLABS ON GROUND SHALL BE REINFORCED CONCRETE TO HAVE MINIMUM 5% JACKS CEMENT PER CU. YD. $f_c = 3000 \text{ P.S.I.}$ REINFORCEMENT, $f_s = 50,000 \text{ P.S.I.}$ TO BE INTERMEDIATE GRADE DEFORMED, CONFORMING TO A.S.T.M. SPEC. A-306. ALL REINFORCING BARS MUST BE IDENTIFIED BY A SYSTEM OF PAINT BRANDING MARK HUNNELL (THIS WILL NOT BE ACCEPTED). REINFORCING STEEL SHALL BE DELIVERED BY AN ENGINEER, APPROVED BY THE ARCHITECT. ALL DETAILS SHALL BE TO THE STANDARD PRACTICE OUTLINED IN THE A.C.I. REPORT 305-SI. REINFORCING STEEL SHALL HAVE CLEAR EMBEDMENT IN CONCRETE AS FOLLOWS: FOOTINGS 5"; BEAMS & COLUMNS 3" (STANCHIONS & TIES); SLABS 4"; WALLS, COLUMNS, BEAMS & SLABS AGAINST EARTH 5". ALL REINFORCING STEEL TO LAP 50 DIAMETERS EXCEPT COLUMN VERTICALS TO DIAMETERS.	
SLABS	ALL SLAB AND DECK STEEL SHALL BE ELEGANTLY SUPPORTED USING CONCRETE BLOCKS TO APPROVED METAL SUPPORTS, PROVIDE 3/4" RAILING BARS IN ALL SLABS WHERE MAIN SLAB STEEL IS PARALLEL TO A BEAM OR WALL, PROVIDE 1/2" AT 12" IN TOP OF SLAB AT RIGHT ANGLES TO BEAM OR WALL, WHERE SLAB IS AT 90° TO BEAM OR WALL, PROVIDE 3/4" AT 12" LONG; WHERE SLAB IS AT ANGLE OTHER, BARS TO BE 3/4" LONG, PROVIDE TEMPERATURE STEEL TIEBARS TO 3/4" FOR SLABS 4" THICK AND UNDER, 1/2" AT 12" FOR SLABS 4 1/2" TO 7" THICK AND 1/2" AT 12" FOR SLABS OVER 7".	
WALLS	ALL 6" CONCRETE WALLS SHALL REINFORCE WITH 5/8" AT 12" O.C. HORIZ. AND VERT. IN CENTER OF WALL. ALL OPENINGS IN CONCRETE WALLS TO HAVE 1-3/4" EXTRA BARS AT TOP, BOTTOM AND SIDES, EXTENDING 30 DIAM. BEYOND CORNERS, PROVIDE 1-3/4" 4-0" DIAGONAL BARS AT EACH CORNER. AT ALL CORNERS AND INTERSECTIONS, EXTEND WALL STEEL WITHIN 1" OF OUTSIDE FACE AND LAP WITH 1/2" (30 DIAM.) OF SAME SIZE AND SPECIES AS WALL STEEL, PROVIDE 1-3/4" 4-0" ELEVATED AT TOP, OUTSIDE FACE OF CORNERS OF CHASE BEAMS AT EXTERIOR WALLS. MIN. 2-5/8" FOR ALL WALLS.	
CONCRETE REINFORCING	ALL BLOCKS SHALL BE LAPPED IN CENTER LINE. METAL COMPOSITION OF ONE PART LIME PUTTY, TWO PART PORTLAND CEMENT, AND FOUR PARTS TWO SIX PARTS SAND BY VOLUME. ALL WALLS SHALL BE REINFORCED HORIZONTALLY WITH K-WEB (OR EQUIV.) EMBEDDED IN MORTAR EVERY THIRD COURSE (16" C.) LAP 12" MIN. AT SPICES; AT CORNERS (OR INTERSECTIONS), CUT THE DIAGONAL WEB STEEL AND REPLACE WITH LONGITUDINAL BARS 1" ABOVE THE CORNER. ALL BOND BEAMS SHALL BE FORMED FULL OF 2500 P.S.I. CONCRETE. REINFORCING STEEL IN BOND BEAMS SHALL BE KEPT 1" CLEAR OF BOTTOM AND 1" CLEAR OF TOP. AT CORNERS AND INTERSECTIONS, LAP ALL 10L. 6" BOND BEAMS REINFORCED WITH ELBOW BARS (3/32" DIAM) SAME SIZE AS BOND BEAM STEEL. AT WALL INTERSECTIONS AND CORNERS, THE BLOCKS SHALL BE JOINT-TAILED TOGETHER AND REINFORCED WITH K-WEB AT RIGHT ANGLES.	
FIBER	ALL STRUCTURAL FIBER OR LUMBER SHALL BE DOUGLAS FIR, NOT FRAMING LUMBER, 1-1/2" x 50" (UNLESS PER. 104, BEAMS PER. 124, POST & BEARING STEEL PER. 204 & 210, W.C.A. GRADING RULES). ALL JOINT HANGERS SHALL BE FULLY IN CABLE. THE NOTATION "N" ON THE PLAN INDICATES JOINT HANGERS. ALL 1" ROOF AND FLOOR BRACING AND JOISTPLAYS SHALL BE LAID DIAGONALLY, FLOOR BRACING JOISTPLAYS. ALL PARTITIONS WHICH EXTEND AT LEAST HALF THE JOIST SPAN, ALL ROOF BEAMS AND ROOF BEARING ACROSS ROOF SHALL BE PROVIDED WITH 1/2" WIDERS, ALL NAILERS TO STEEL BEAMS SHALL BE ATTACHED WITH 3/4" BOLTS AT 36" O.C. (STAGGERED WHERE POSSIBLE). ALL WOOD BEARING ON OR INSTALLED WITHIN 1" OF CONCRETE OR CONCRETE SHALL BE TREATED WITH AN APPROVED PRESERVATIVE.	
GLASS LAMINATE & MEMBRANE	GLASS LAMINATE BLOCKS SHALL BE FABRICATED BY DOUGLAS FIR, DESIGN STRESS IS NOTED ON ARCH. DETAIL, BY A FABRICATOR, APPROVED BY THE ARCHITECT. ALL PIECES SHALL BE DRIVEN TO A MINIMUM CONTENT OF 74% W.C. ALL SLICES SHALL BE SCAR JOINTED, 1/2" D. CLOS. GLUES USED SHALL BE LAMCO'S CASIN 8000 OR APPROVED RANAL AND SHALL CONTAIN A MOIST INHIBITOR (APPLIED PER. MANUFACTURER'S SPEC.). THE GLUE SHALL BE APPLIED AFTER TRIMMING WITH A COAT OF APPROVED SEALER, AND THE ENTIRE SURFACE GIVEN A PRIME SHEET OF LINEN OR OIL PAINT. WHEN THE GLUE SHALL BE WRAPPED FOR SHIPMENT WITH A HEAVY GRADE OF WATERPROOF PAPER.	
STRUCTURAL STEEL	ALL STRUCTURAL STEEL CONSTRUCTION TO BE DEFORMED, $f_y = 50,000 \text{ P.S.I.}$ ALL STEEL SHALL BE STRUCTURAL GRADE CONFORMING TO A.S.T.M. A-36 AND SHALL BE GIVEN A SHOP COAT OF OIL-BASED PAINT (EXCEPT ANY STEEL EMBEDDED IN CONCRETE). ALL WELDING SHALL BE PERFORMED BY CERTIFIED WELDERS USING HEAVY COATED ELECTRODES, UNLESS OTHERWISE NOTED. ALL WELDS TO BE 3/8" CONFIRMED FILLET WELDS. SHOP CONNECTIONS MAY BE WELDED OR BOLTED AND FIELD CONNECTIONS BOLTED. THE CONNECTION OF ALL STRUCTURAL STEEL SHALL BE SECURED FROM COLLAPSING WITH TEMPORARILY BRACING UNTIL PERMANENT BRACING HAS BEEN INSTALLED.	



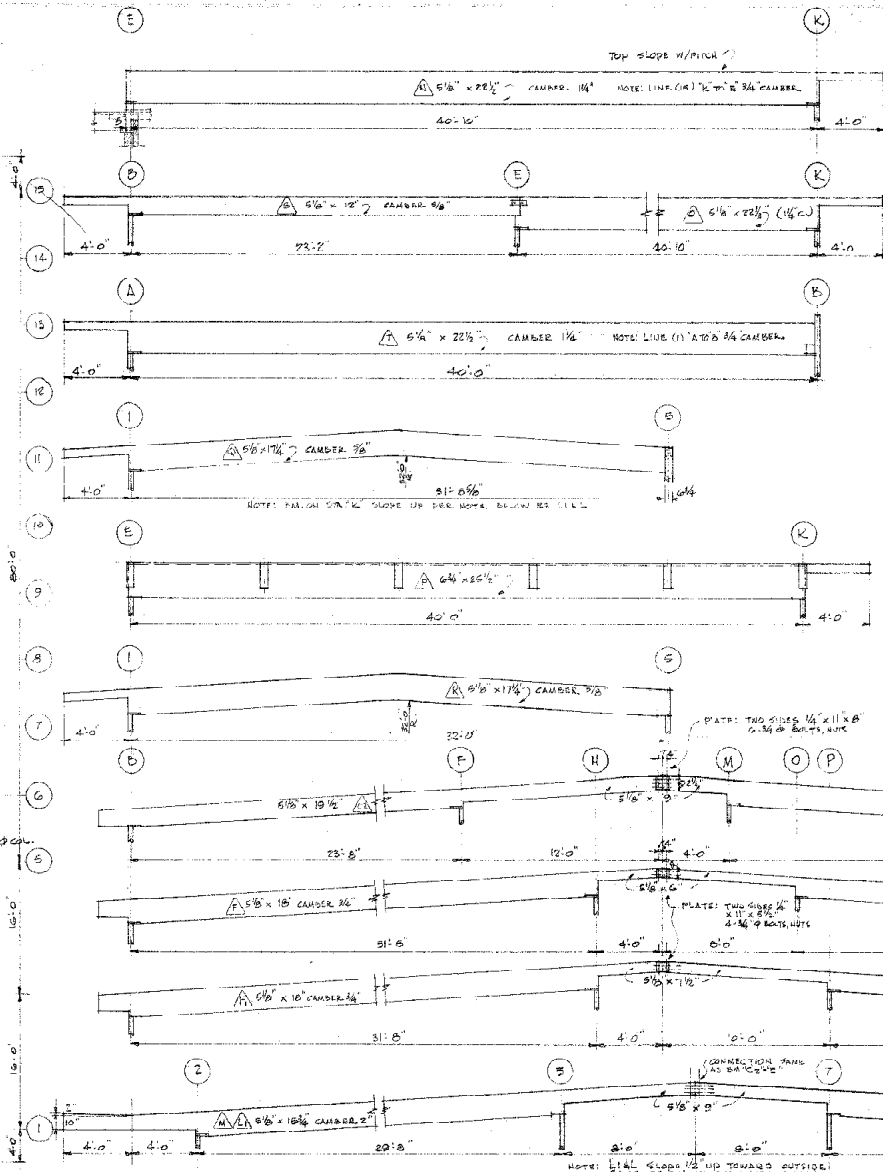
TYPE 'A' TYPE 'B'
TYPICAL JOIST ANCHORS ~ JOISTS PERPENDICULAR TO WALL OF

APPROVED: *Wesley Smith*
PRESIDENT OF BOARD
DATE: *1/21/53*
Wesley Smith

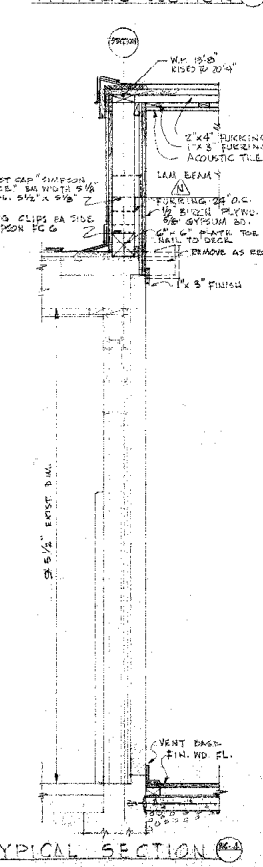
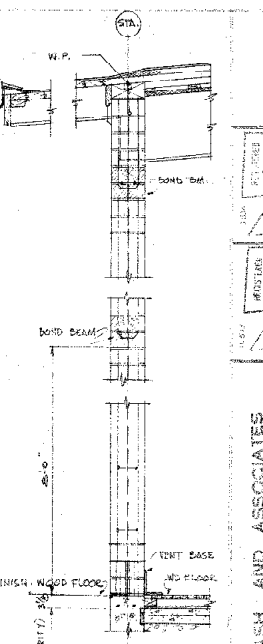
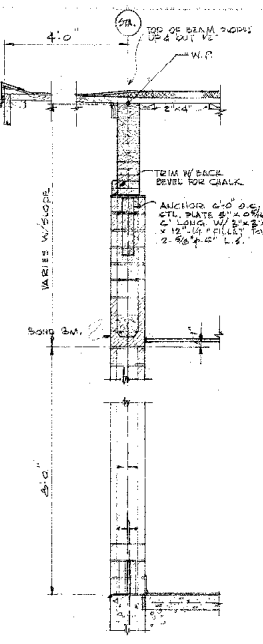
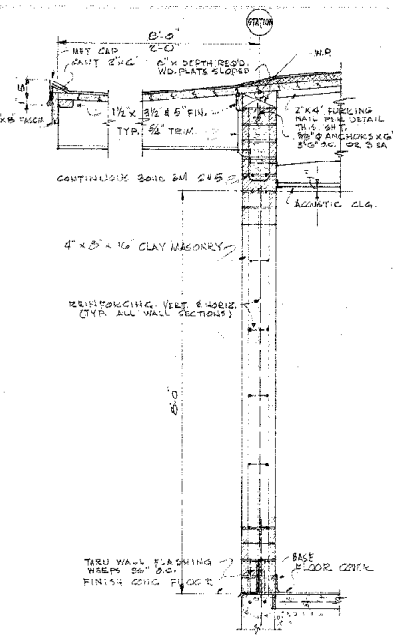
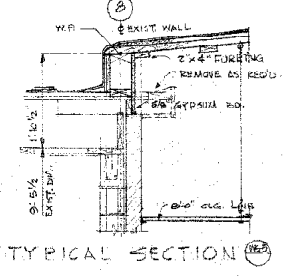




BUILDING "C" ROOF PLAN
 SCALE 1/8" = 1'-0"



LAMINATED WOOD BEAM DETAILS FOR OTHERS SEE SHEET A-3
 (COMBINATION "B" - 1" = 2"00 R.S.I.)



STRUCTURAL NOTES

A. GENERAL:

The following structural notes are supplementary and are not intended to supersede the specifications and/or details shown on the drawings.

B. CODES:

Uniform Building Code (U.B.C.), 1982 Edition.

C. LIVE LOADS:

Roof (snow)	25 psf
Wind	80 MPH (protected)
Mechanical Room Floor	100 psf
Stairs & Exits	100 psf
Seismic Zone (U.B.C. 2312)	3
Earth Pressure	30 psf equivalent fluid pressure.

D. FOUNDATION DATA:

- Soil: Per MTC Soils Report dated 2-19-85.
Design bearing strength 1,500 psf.
- Extend all footings down to undisturbed soil of the specified strength with a minimum of 2'-0" below adjacent finished grade.
- Center footings on columns and walls above unless specifically dimensioned otherwise.
- Compacted fill to be well graded and granular with not more than 5% passing a 200 sieve. Place in 6-inch loose lifts and compact to 95% Modified AASHTO density at optimum moisture content.

E. CAST IN PLACE CONCRETE & REINFORCING STEEL:

- Concrete of following 28-day strength:
2,000 psi (5 sack cement/cyd; max. 6 gal. water/sack) for all structural concrete, including foundations and slabs on grade.
Maximum size aggregate 1-1/2". Maximum slump 4".
Add Master Builders Pozzolith per mfr's recommendations to all concrete except footings.
Concrete for exterior walls to be air entrained (5% air).
Reinforcing steel ASTM A-615 Grade 40.
Detail, fabricate and place in accordance with the latest edition of A.C.I., "Manual of Standard Practice."
Submit shop drawings for approval prior to fabrication.
- Concrete cover on reinforcing steel (clear dimensions):
Non-exposed vertical faces 1"
Vertical faces exposed to earth or weather 2"
Bottom or footings 3"
Slabs 1-1/2" (from top).
- Lap all field splices 24 diameters with minimum of 12 inches. Bend outer wall and footing bars 12 inches or use corner bars at all corners and wall intersections.
- Provide two continuous #3 bars in top of foundation walls and in footings.
Dowel foundation walls to footings with #5 x 1'-6" long @ 24" o.c. Embed 5" into footing. No shearkeys required.
- Reinforce around wall and slab openings with sides of 12" or greater with two #5 bars extending 24 inches beyond corners on all four sides. Provide one extra #3 diagonal bar, 4'-0" long at each corner.
- 4-inch Slabs on grade (non-reinforced) to have 1-inch deep surface joints at 12'-0" max. o.c. Sawcut within 24 hours of pour or install Zip-Strip.
- Vibrate all concrete. Segregation of materials to be prevented. Test cylinders are required.
- Dowel new to existing concrete with 5/8-inch diameter x 1'-0" long plain dowels, drilled 6" into existing work and spaced at 16" o.c.

F. MASONRY: (Special Inspection Required)

- Hollow masonry units: #1 2,500 psi min. (S.C.R. Hollow Clay Brick); #1 1,350 psi (C.M.U.).
Mortar: Type S: 1 PC, 1/2 lime putty, 4 sand (U.B.C. 240).
Grout: 3,000 psi deaggravel concrete (1 sack).
- Reinforcing Steel ASTM A-615, Grade 40.
- Place grouts in lifts no higher than 4'-0".
- Wall reinforcing:
4" and 6" Wall: #4 vert. @ 48" o.c., #3 wire mesh joint, r/f @ 8" o.c.
Install two bars in corners, wall intersections, wall endings and around openings. Lap all bars 30 inches, joint r/f 12 inches. Use corner bars for outer bars in bond beams and at intersecting walls.
With two #3 bars in bottom, extending 6" beyond openings.
- Embed all reinforcing, anchor bolts, anchors, etc. in solid grout for full length and depth.
- Dowel all vert. wall steel to foundation. Min. lap 20 inches.
- Dowel new walls to existing walls at 16-inch intervals with 5/8-inch dia. x 1'-6" long plain dowels drilled 6" into existing work.
- Install vertical crack control joints at 40'-0" o.c. max. with "Dun-O-Wall Rapid Control Joint" in standard sash block. Discontinue joint r/f at control joint. Continuous reinforced bond beams across control joint at floors and roof.
- Steel lintels to have min. bearing length of 8 inches. Drill two holes in flanges to let sand r/f pass through. Weld 20-inch long dowels to top of lintels to match vertical wall r/f.
- Anchor brick veneer to wood frame walls with 22 ga. x 7/8" x 7" galv. corrugated wall ties @ 16" o.c. each way with (1) Simpson N804 nail.

G. TIMBER FRAMING:

- All lumber to be graded per Book No. 16 of the West Coast Lumber Inspection Bureau.
DF "No. 2" for joists, rafters and light framing, plates, bracing and 4" wide beams.
DF "No. 1" for posts and other beams.
DF "Stud" for standard studs.
- Comply with latest edition of the N.F.P.A. "National Design Specification" as modified by the U.B.C. for all structural timber requirements.
- Joists and rafters to have 2" thick solid blocking at supports.
12" x 6" staggered. "Splice laminations" at supports only.
- Provide cut washers for all bolts bearing on wood.
- All nails shall be common wire nails.
- Blue-laminated timbers, Douglas Fir, A.I.T.C.-grading.
Combination 24F-V3; dry condition of use.
Architectural appearance grade, where exposed to view.
Fabricating plant A.I.T.C. inspected.
Wrap individual members.
Submit shop drawings for approval prior to fabrication.
- Plywood:
Roof sheathing to be 1/2" C-D INT-APA plywood with exterior glue, P.I. 24/0. Nailing 8d @ 6" o.c. at panel edges, 8d @ 12" o.c. at intermediate supports.
Subflooring to be 3/4" T&G C-D INT-APA plywood with exterior glue, P.I. 32/16. Nailing 10d @ 6" o.c. at panel edges, 10d @ 10" o.c. at intermediate supports.
- Pre-fabricated trussed members to be designed by a Washington State licensed structural engineer and in

accordance with the requirements shown. Submit complete shop drawings with engineer's seal for approval prior to fabrication.

H. STRUCTURAL STEEL:

- All steel, except tubing: ASTM A-36.
Pipe: ASTM A-53, Type E or S, Grade B.
Tubular section: ASTM A500, Grade B.
All bolts: ASTM A-307.
All fabrication, erection and detailing in accordance with the latest edition of the "Manual of Steel Construction" of the American Institute of Steel Construction.
All welding by WABO certified welders in accordance with the "Welding Handbook" by the American Welding Society.
All welds 3/16" min. continuous fillet welds using AGW A5, E70XX electrodes.
Provide washers on bolted connections.
All steel not embedded in concrete or masonry to receive one shop coat of an approved primer paint. Apply two coats of heavy asphaltic paint to all steel exposed to earth.
Furnish complete shop drawings prior to fabrication.
Metal roof deck fabricator to submit shop drawings showing layouts, welding patterns at supports, perimeter and side laps, thus providing a diaphragm capable of resisting lateral shear forces as shown. Provide steel headers at all openings through the deck to satisfactorily distribute the load to supporting members.

I. MISCELLANEOUS:

- Contractor to verify all dimensions in the field.
- Provide temporary bracing as required until all permanent connections and stiffenings have been installed.
- Verify size and location of all openings in floor, roof and walls with mechanical and electrical work.
- Pre-fabricated items to be handled and installed per mfr's recommendations.

INDEX OF DRAWINGS

ARCHITECTURAL

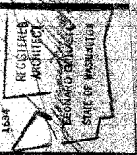
- GN-1 - Structural Notes, Index of Drawings, Etc.
- SA-1 - Site Plan - Building "A"
- SA-2 - Site Plan
- SA-3 - Room Finish Schedules - Buildings "A," "B," "C" & "D"
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- SA-12 - Elevations - Buildings "A" & "B"
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- SA-19 - Court Layout - Building "A"
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- E-2 - Building "A" - Lighting Plan & Schedules
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- E-11 - Building "G" - Second Floor Demolition Plan
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- E-13 - Building "G" - Second Floor Plan

LEGEND

	DETAIL NUMBER
	SHEET NUMBER
	SECTION NUMBER
	SHEET NUMBER
	ROOM NUMBER
	DOOR NUMBER
	RELIEF DESIGNATION
	RELIEF DESIGNATION
	SOLID BLOCKING
	CONTINUOUS MEMBER
	METAL IN SECTION
	METAL IN ELEVATION
	FINISH WOOD
	PLYWOOD
	WOOD FRAME WALL
	CONCRETE IN ELEVATION OR PLAN
	GYPSON WALLBOARD
	BATT-TYPE INSULATION
	RIGID INSULATION
	CONCRETE IN SECTION
	UNDISTURBED EARTH
	GRAVEL OR ROCK FILL
	EXISTING GRADE ELEVATIONS
	NEW GRADE ELEVATIONS
	CONCRETE BLOCK
	CLAY BLOCK



REVISIONS

JOB NO. 659

DATE 4/2/85

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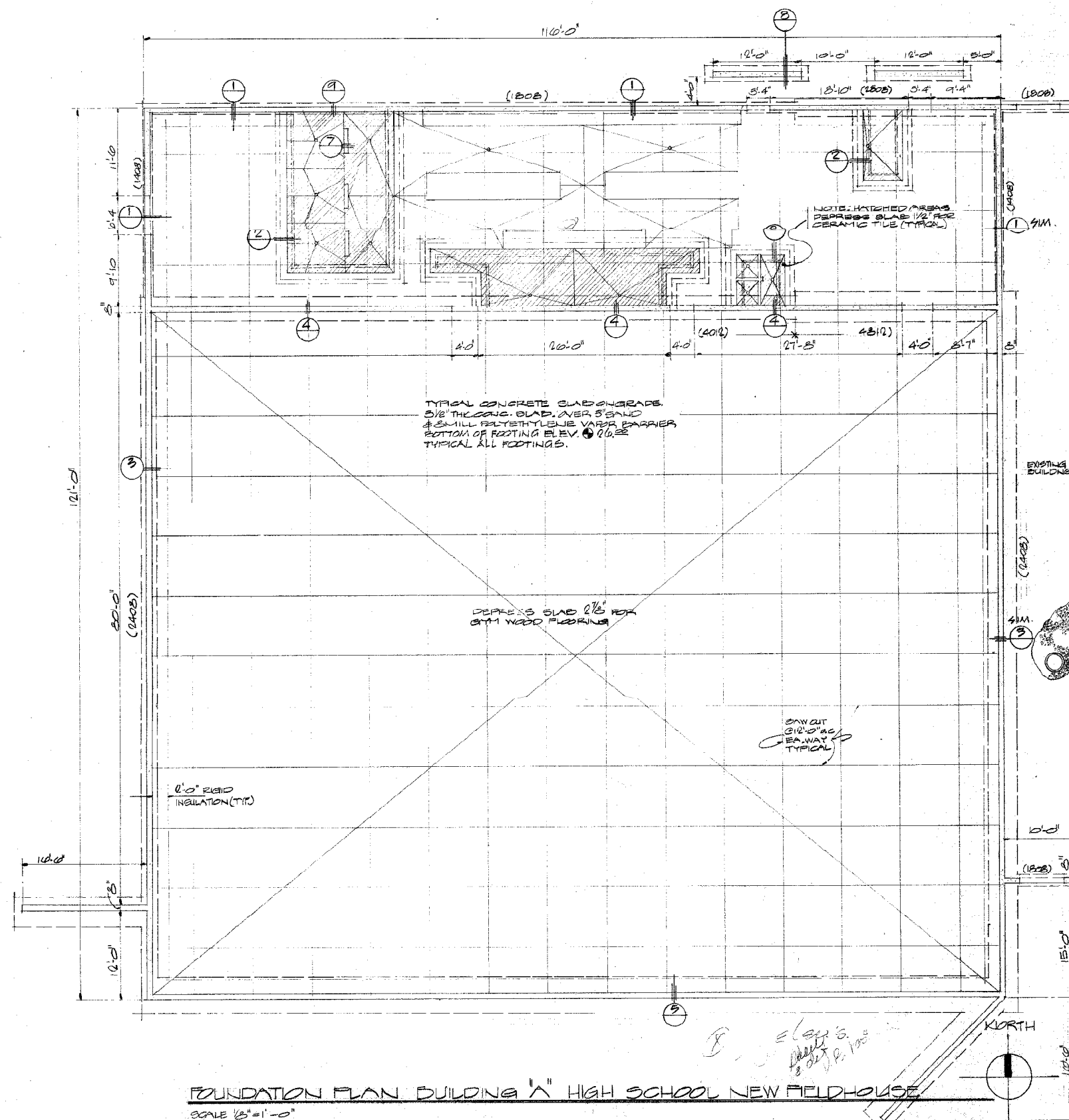
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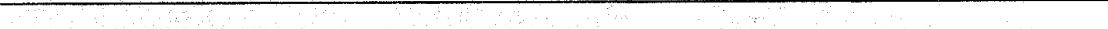
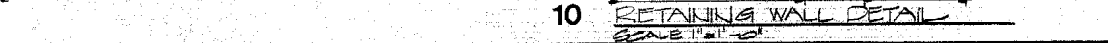
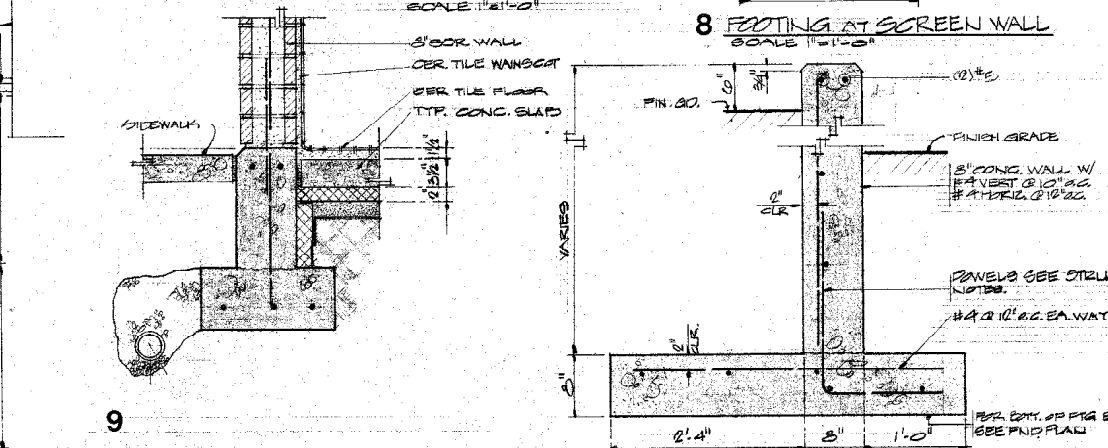
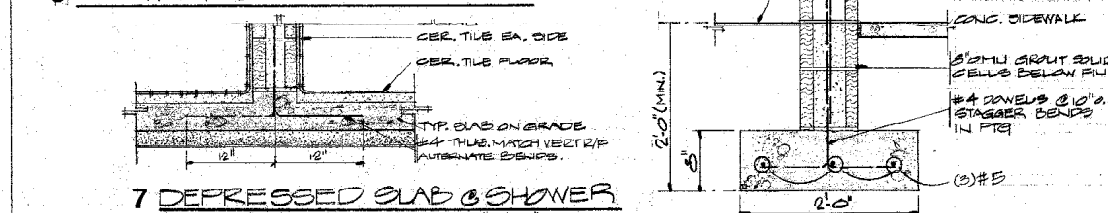
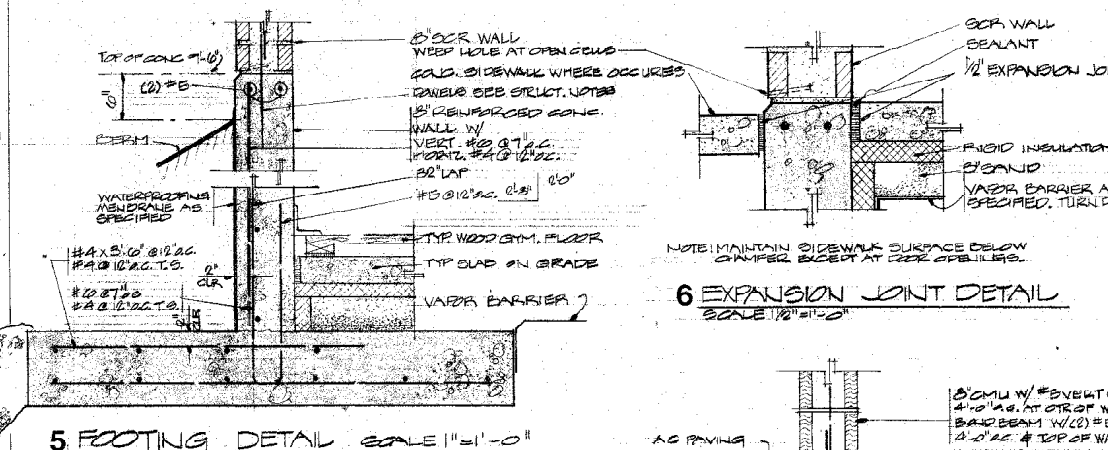
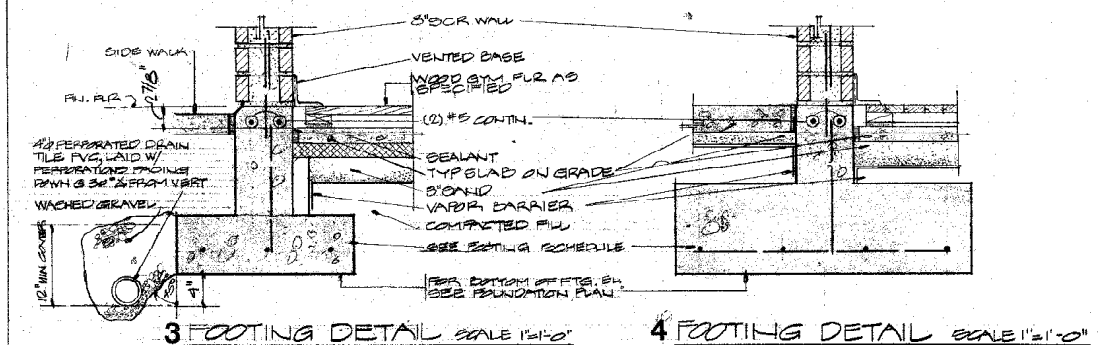
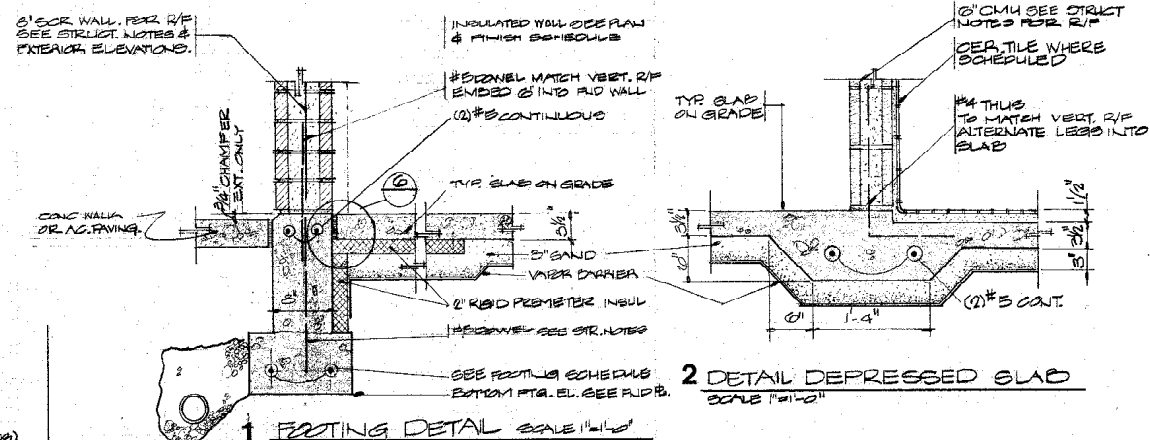
GN-1

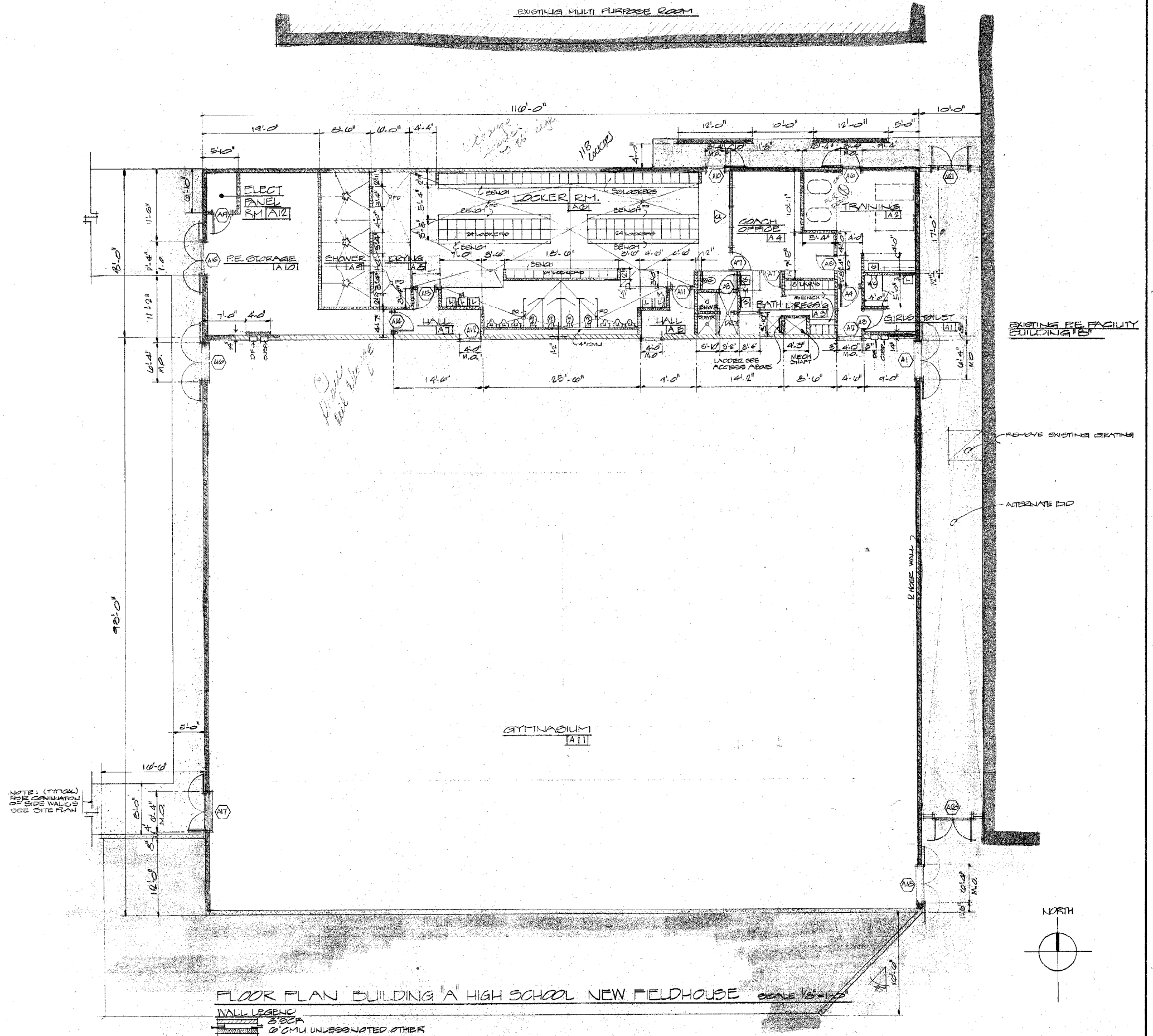
FOOTING SCHEDULE

MARK	WIDTH	THICKNESS	LENGTH	REINFORCING WAY	REINFORCING SHORT WAY
1A08	1'-2"	8"	CONT.	2 #5	---
1B08	1'-6"	8"	---	3 #5	---
2A08	2'-0"	8"	---	3 #5	---
2B10	2'-4"	10"	---	3 #5	---
4B12	3'-4"	12"	---	4 #5	#4 @ 16" O.C.
4B12	4'-0"	12"	CONT.	4 #5	#4 @ 16" O.C.



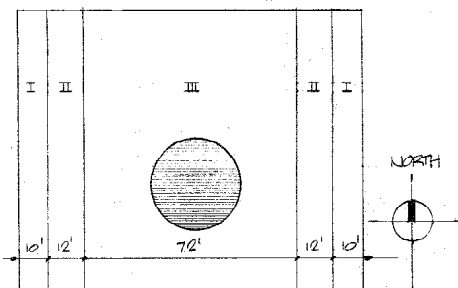
FOUNDATION PLAN BUILDING 'A' HIGH SCHOOL NEW FIELD HOUSE
SCALE 1/8" = 1'-0"





FLOOR PLAN BUILDING 'A'
HIGH SCHOOL NEW FIELD HOUSE
BURLINGTON IDISON SCHOOL DISTRICT NO 100
BURLINGTON WASHINGTON

bh
Botesch, Nash & Hill Architects, P.S.
1216 Hoyt Ave. • Everett, Washington 98203 • 104/219-4868



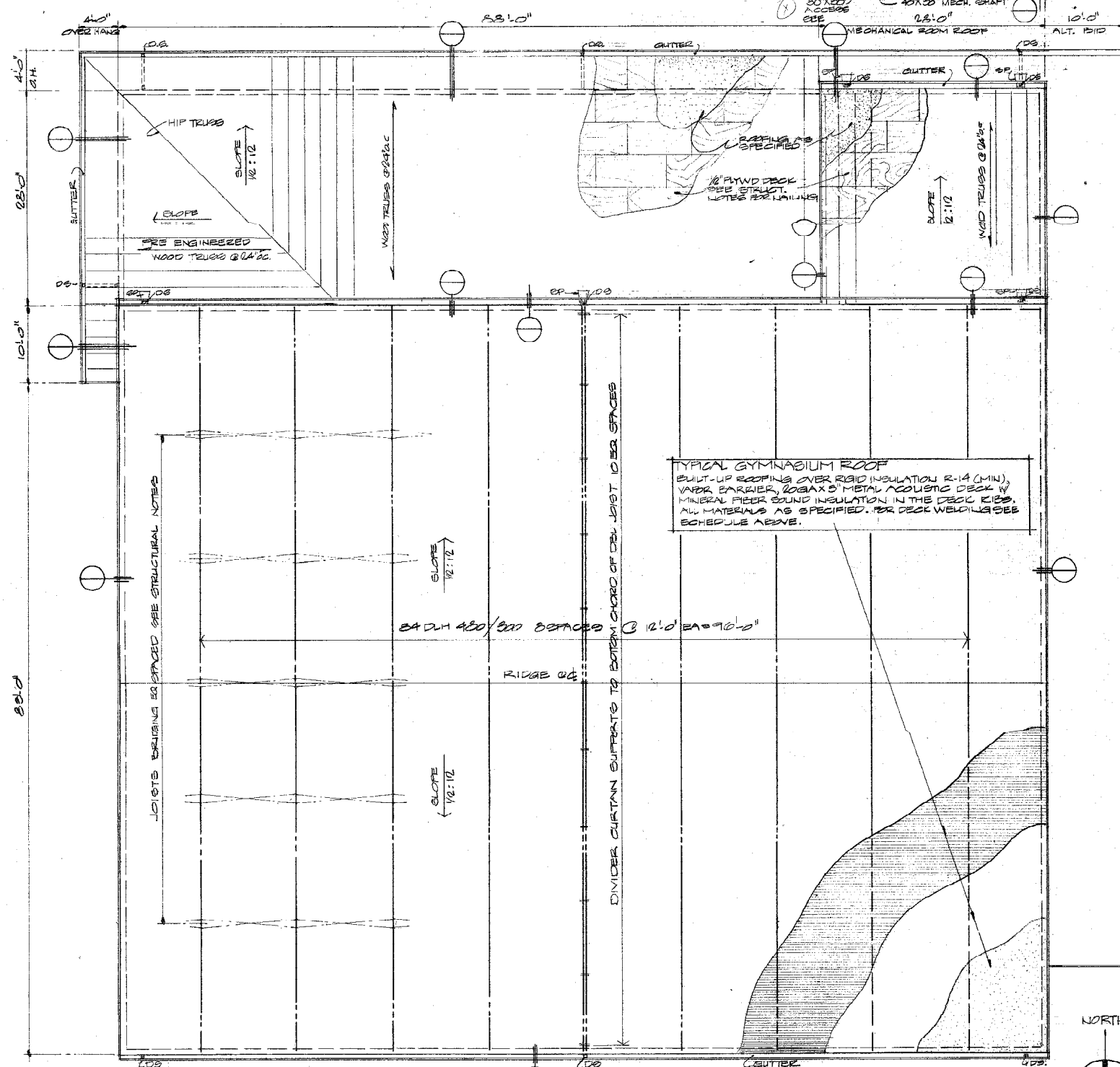
WELDING PATTERN FOR 20 GA. TYPE N VERGEE DECK

AREA	WELD SMT	SPACING ALONG SEAM	1/8" MIN. BUTY PUNCH
I	4	12"	—
II	4	24"	—
III	4	—	24"

SEAM WELDING ALSO APPLIES TO BOUNDARY WELDING & U.P. & E.O. WALLS.

PLAN WELDING PLAN & SCHEDULE

NO SCALE

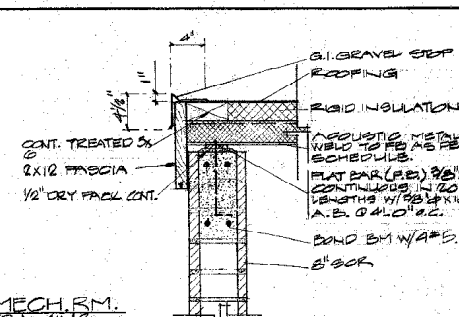


ROOF FRAMING PLAN BUILDING 'A' HIGH SCHOOL NEW FIELDHOUSE

SCALE 1/8" = 1'-0"

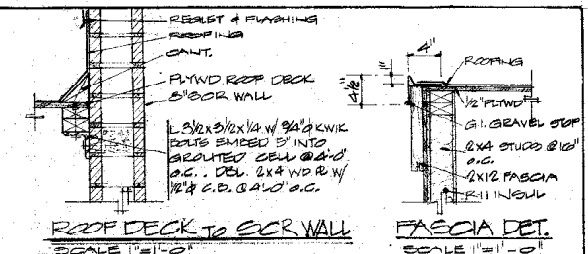
PLAN-MECH RM.
FLOOR FRAMING

SCALE 1/8" = 1'-0"



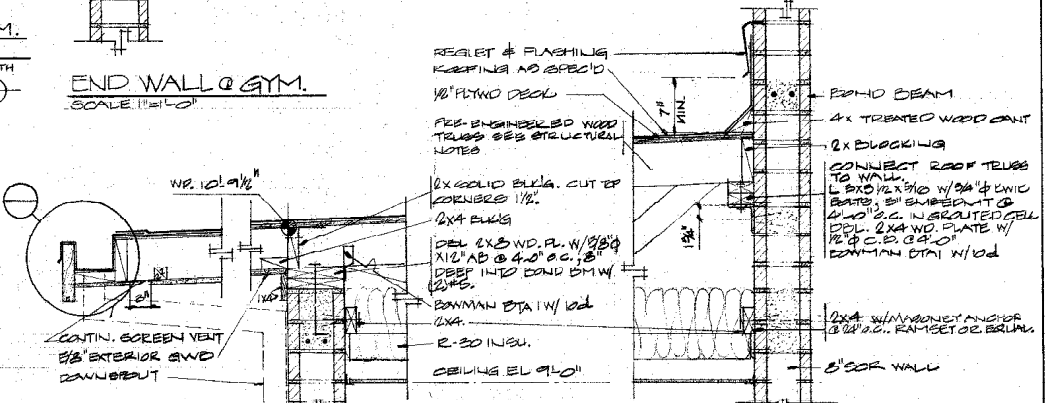
END WALL @ GYM.

SCALE 1/4" = 1'-0"



FASCIA DET.

SCALE 1/4" = 1'-0"

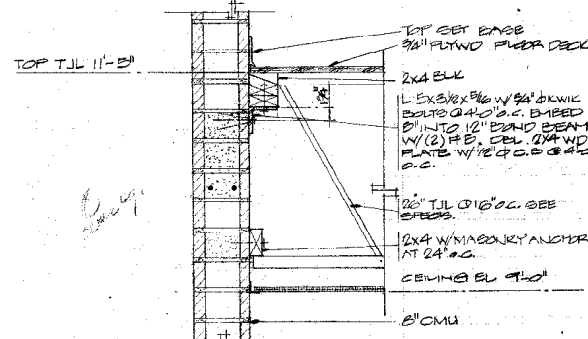


EAVE DETAIL NORTH WALL LKR. RM.

SCALE 1/4" = 1'-0"

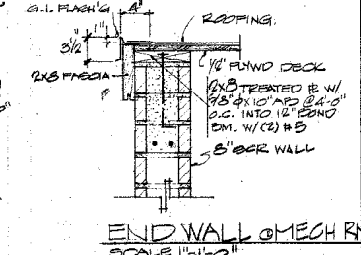
DETAIL LOW ROOF TO WALL

SCALE 1/4" = 1'-0"



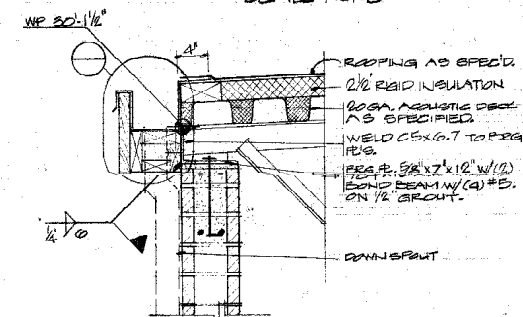
FLOOR JOIST TO WALL

SCALE 1/4" = 1'-0"



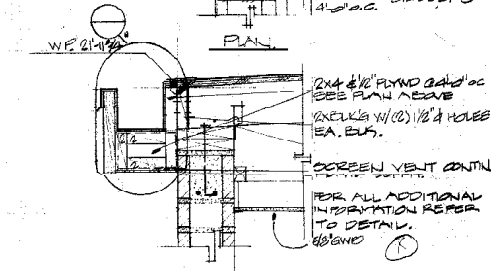
END WALL @ MECH RM.

SCALE 1/4" = 1'-0"

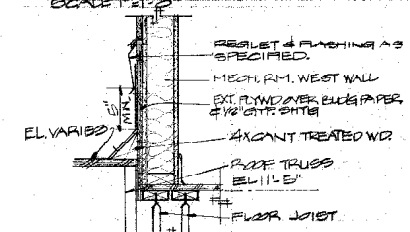


DETAIL HIGH ROOF AT BEARING WALL

SCALE 1/4" = 1'-0"



EAVE @ MECH. ROOM.



LOW ROOF TO MECH. RM. WALL



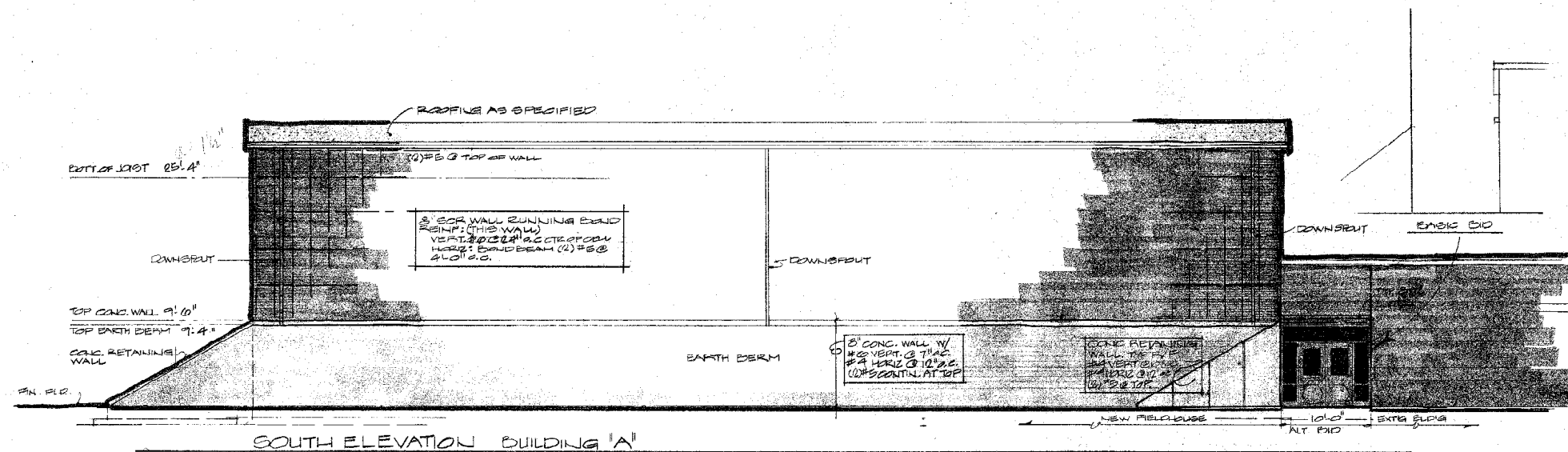
Botesch, Nash & Hill Architects, P.S.
4266 Hoyt Ave. • Everett, Washington 98203 • 206/229-8666

ROOF FRAMING PLAN AND DETAILS BUILDING 'A'
HIGH SCHOOL NEW FIELD HOUSE
BURLINGTON IDISON SCHOOL DISTRICT NO 100
BURLINGTON WASHINGTON

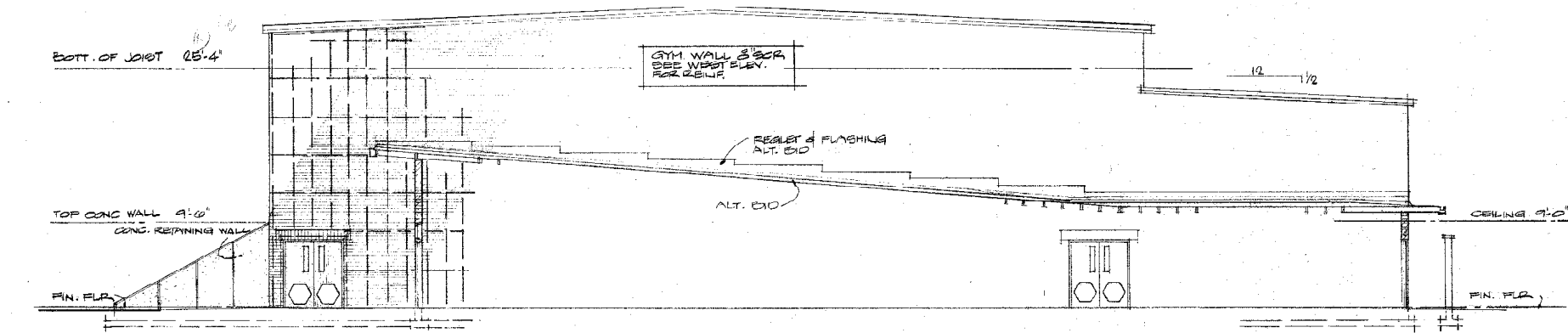
REVISIONS

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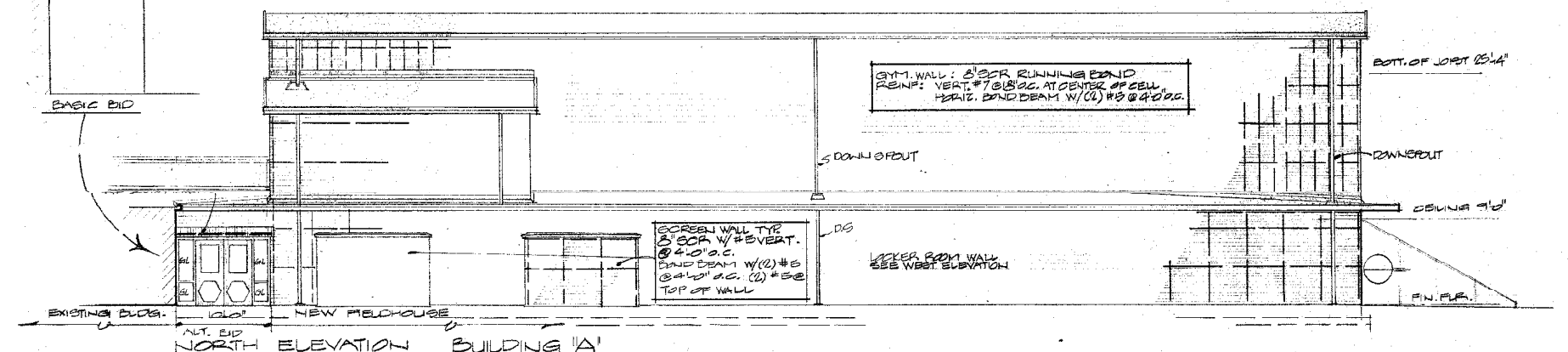
SHEET NO
A.5
OF 19



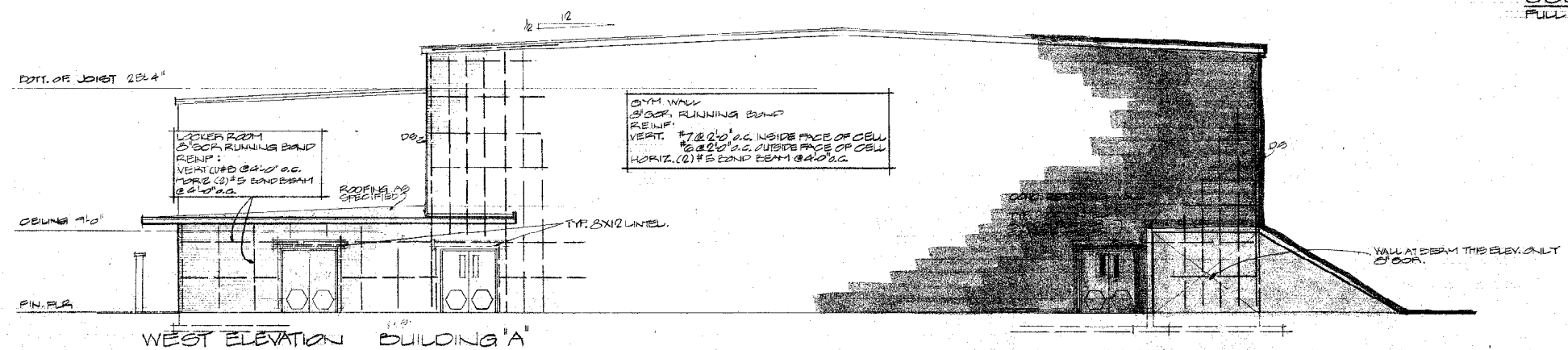
SOUTH ELEVATION BUILDING 'A'



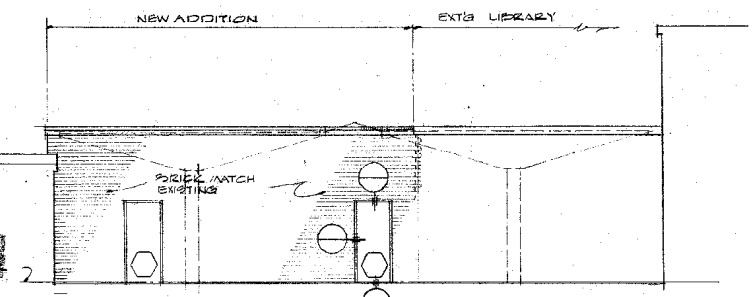
EAST ELEVATION BUILDING 'A'



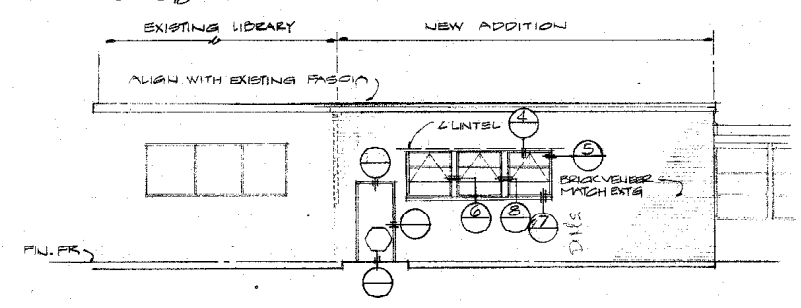
NORTH ELEVATION BUILDING 'A'



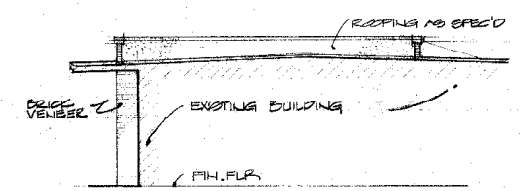
WEST ELEVATION BUILDING 'A'



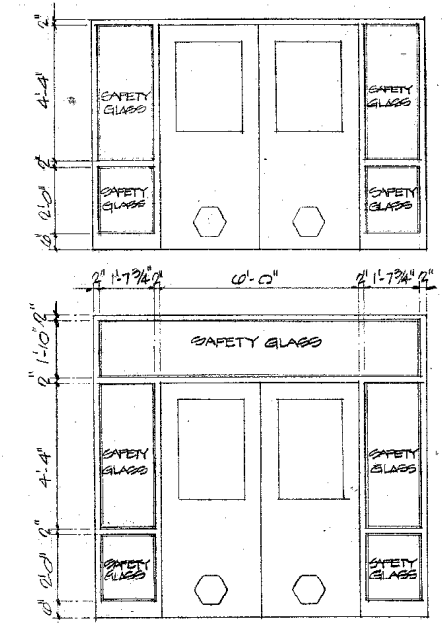
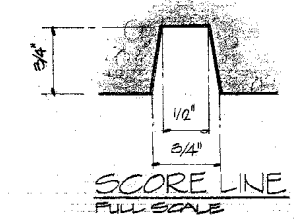
WEST ELEVATION BUILDING 'D'



EAST ELEVATION BUILDING 'D'



NORTH ELEVATION BUILDING 'D'



HOLLOW METAL FRAMES FOR ALTERNATE B/D BUILDING 'A'. SCALE 3/8" = 1'-0"

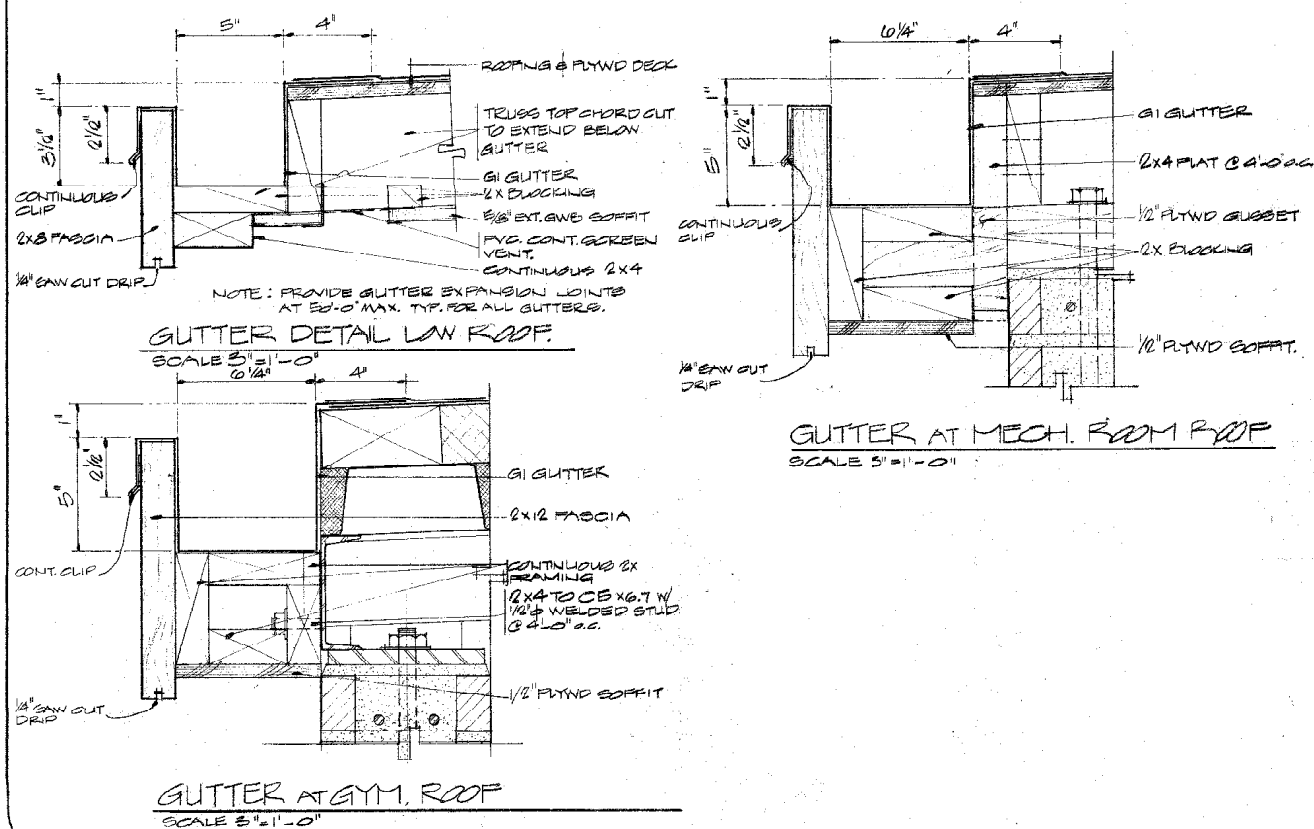
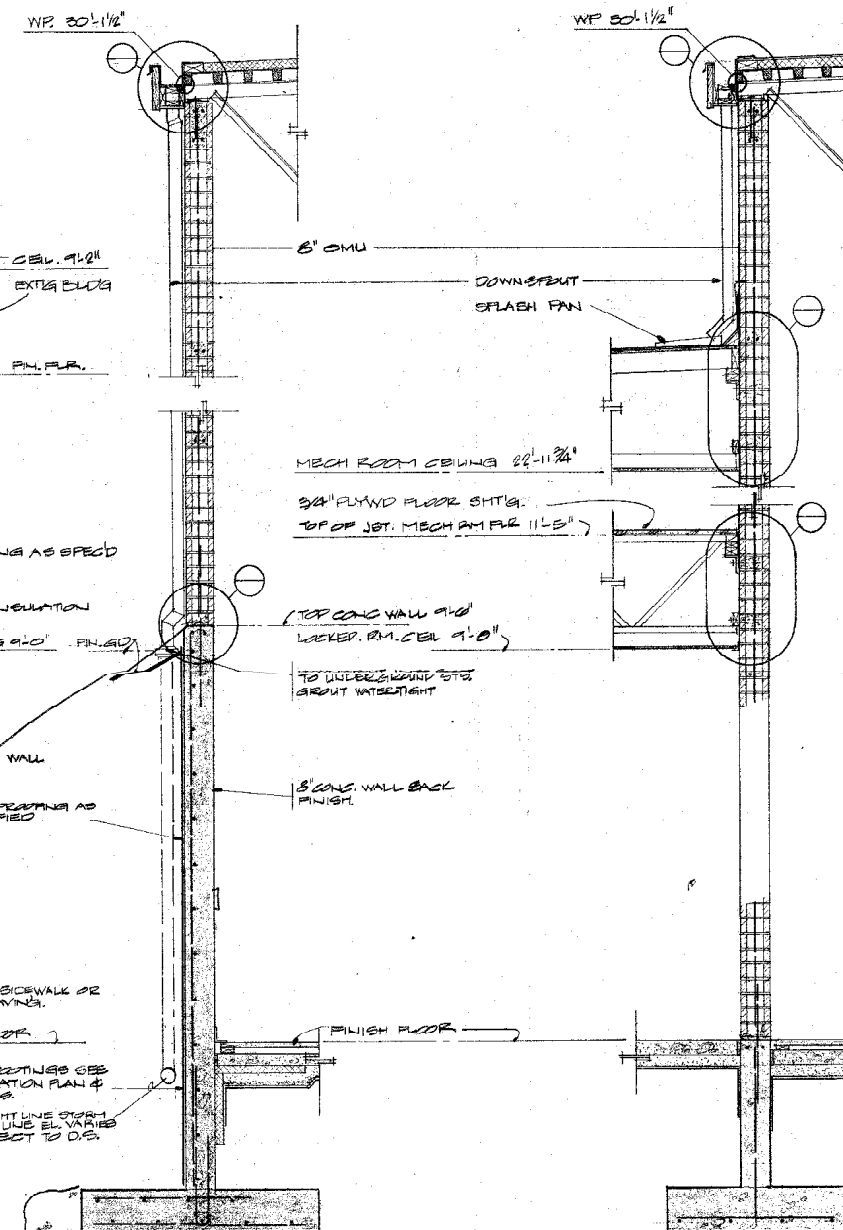
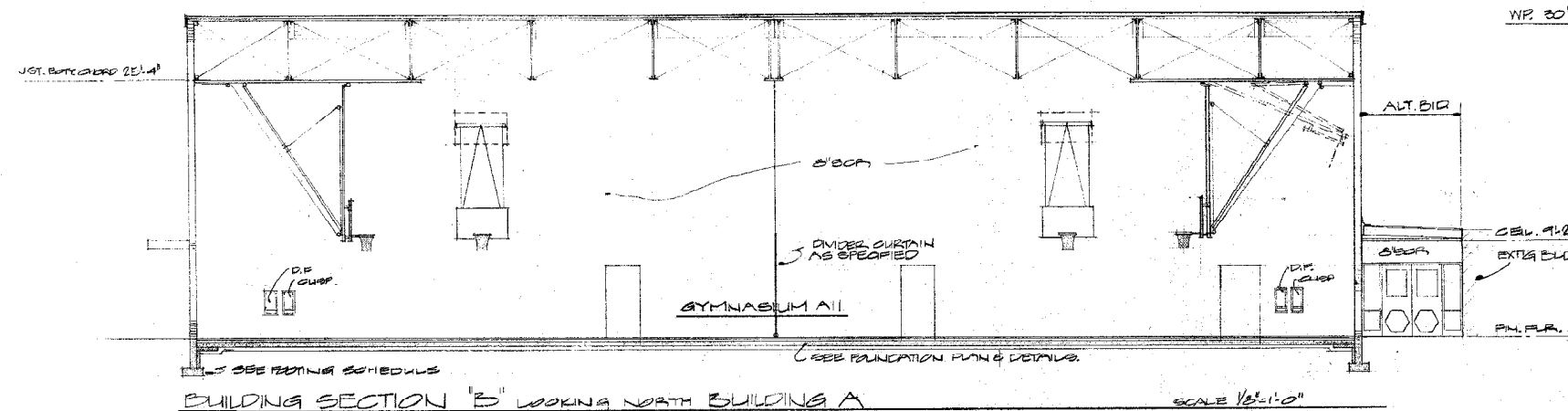
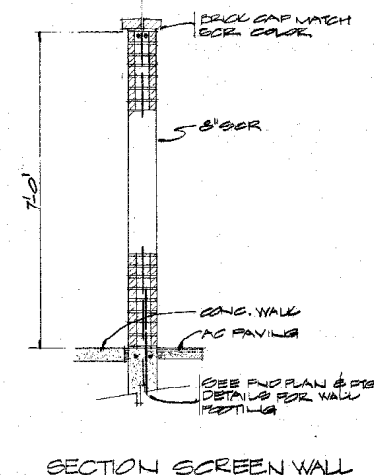
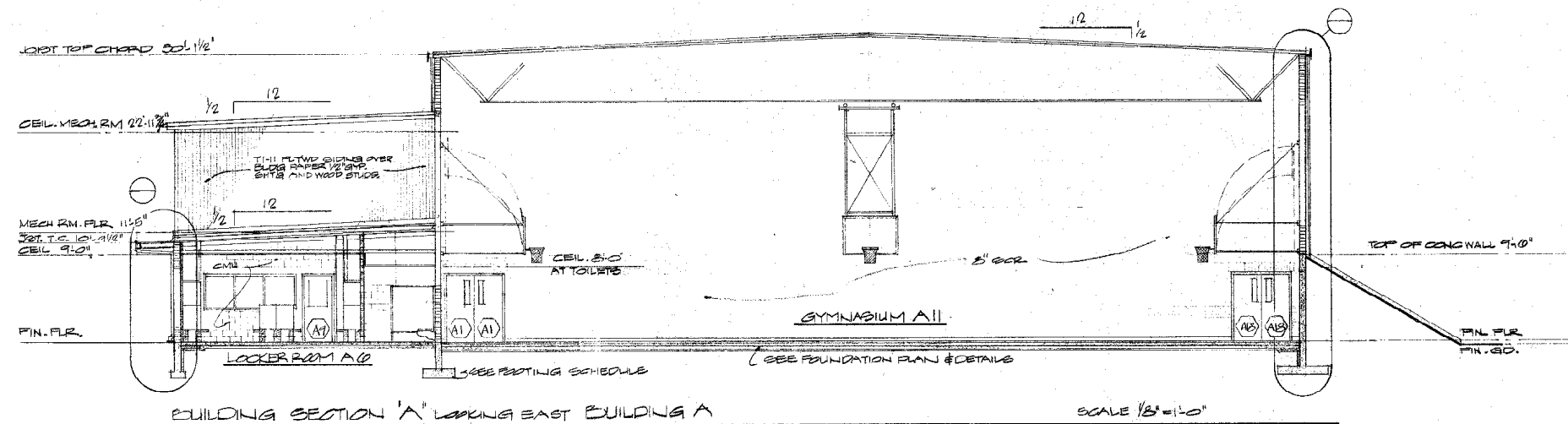
ELEVATIONS BUILDING A AND D
HIGH SCHOOL NEW FIELD HOUSE
BURLINGTON EDISON SCHOOL DISTRICT NO 100
BURLINGTON WASHINGTON

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BUILDING AND WALL SECTIONS BUILDING 'A'

HIGH SCHOOL NEW FIELD HOUSE

BURLINGTON EDISON SCHOOL DISTRICT NO 100

BURLINGTON WASHINGTON

REVISIONS

JOB NO 659

DATE

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OF 19

Boesch, Nash & Hill Architects, P.S.

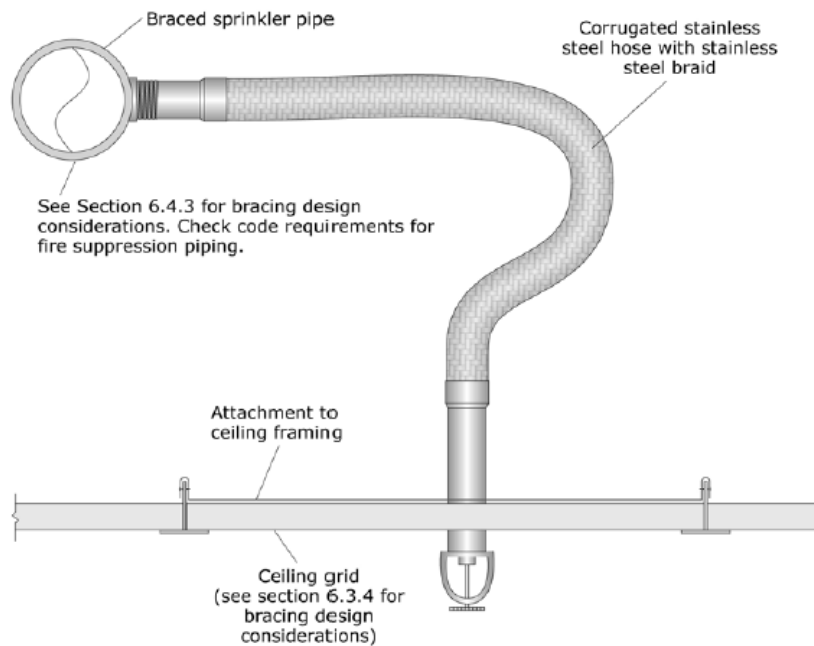
4206 Hoyt Ave. • Everett, Washington 98203 • 206/259-0868

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Appendix F: FEMA E-74 Nonstructural Seismic Bracing Excerpts

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Life Safety Systems



Note: for seismic design category D, E & F, the flexible sprinkler hose fitting must accommodate at least 1" of ceiling movement without use of an oversized opening. Alternatively, the sprinkler head must have a 2" oversize ring or adapter that allows 1" movement in all directions.

Figure G-1. Flexible Sprinkler Drop.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

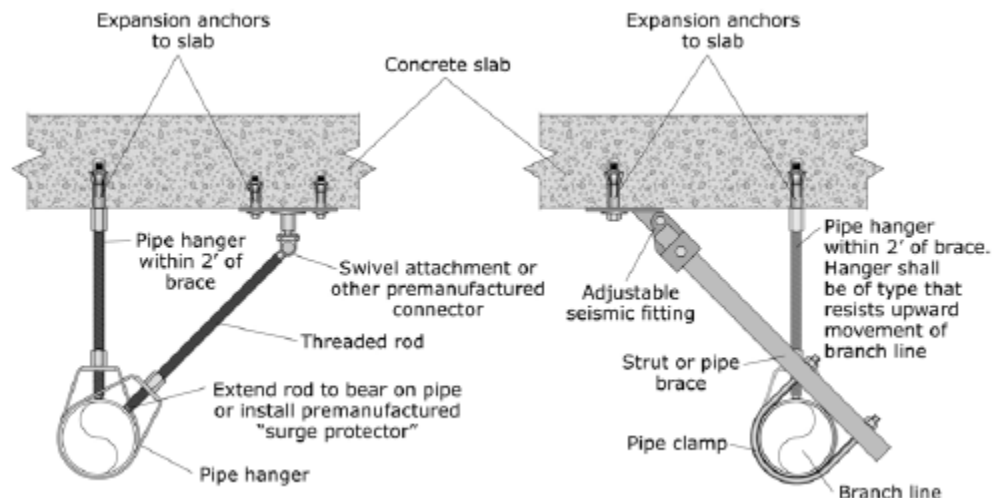


Figure G-2. End of Line Restraint.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Partitions

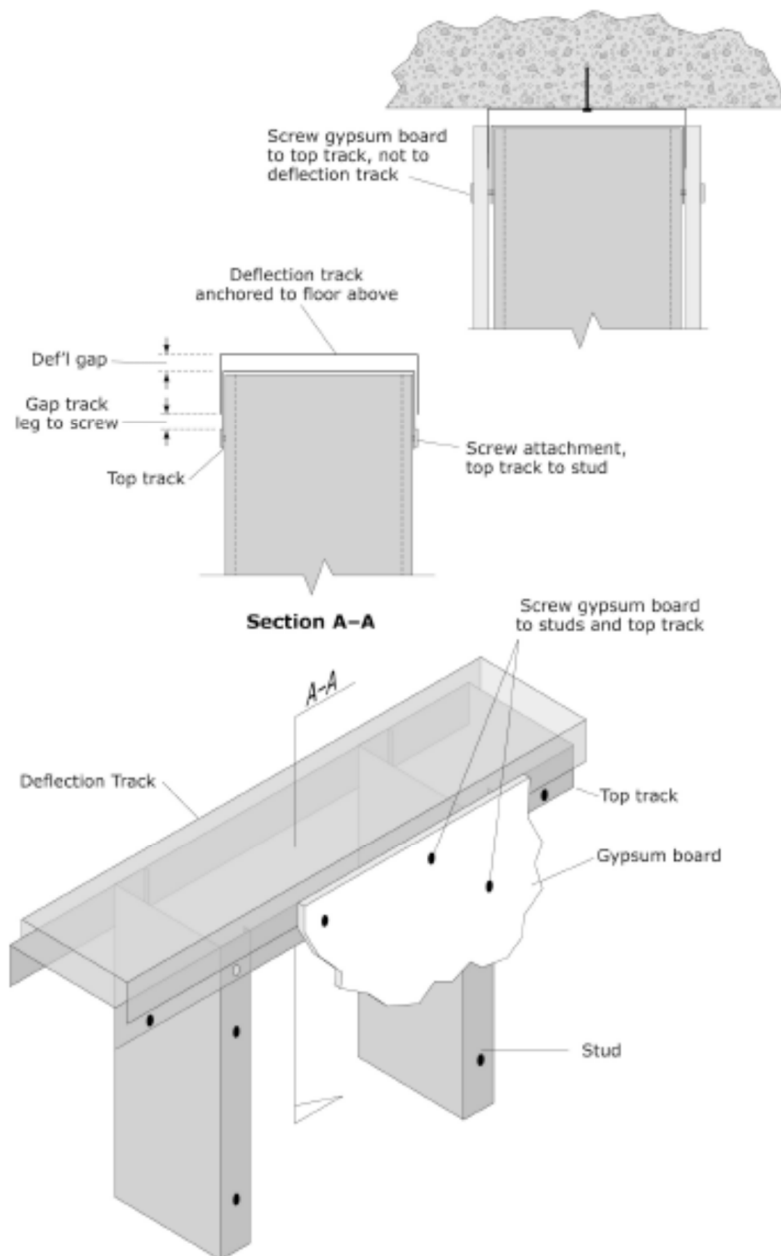


Figure G-3. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

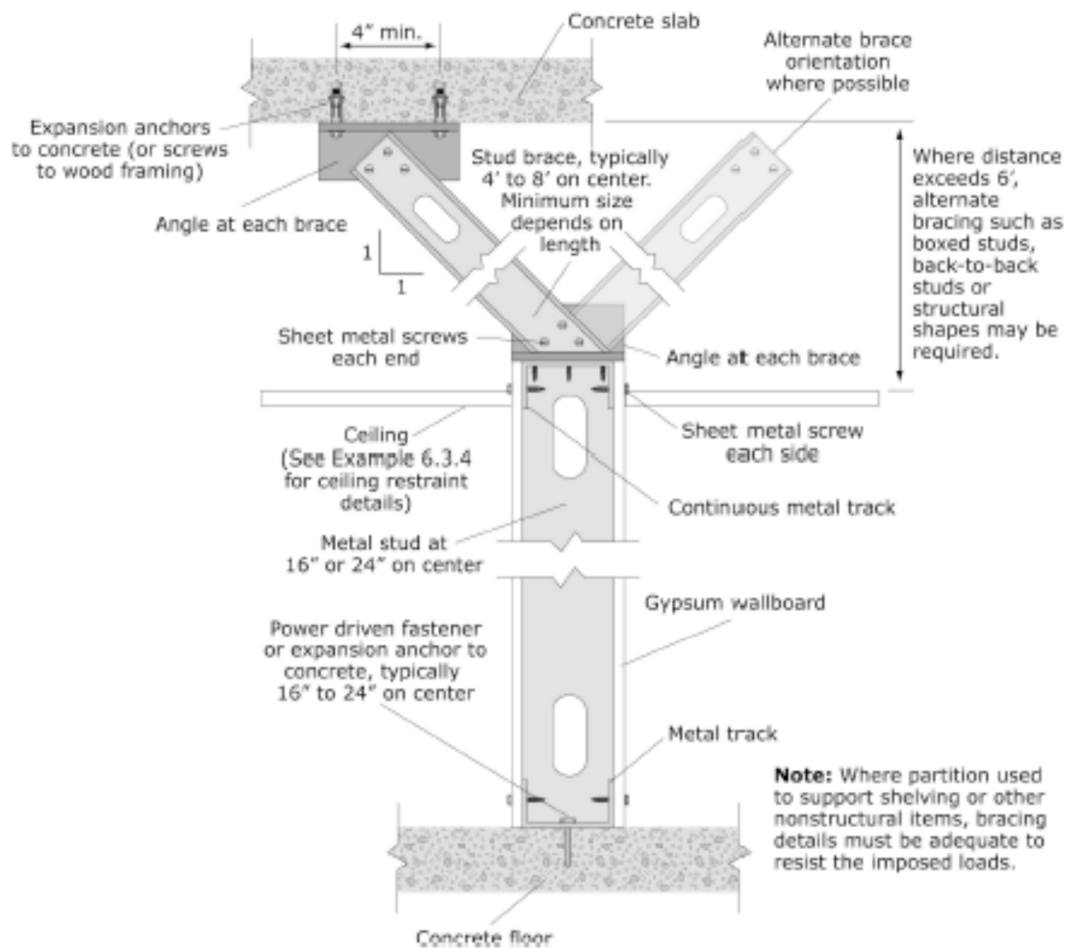


Figure G-4. Mitigation Schemes for Bracing the Tops of Metal Stud Partitions Walls.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

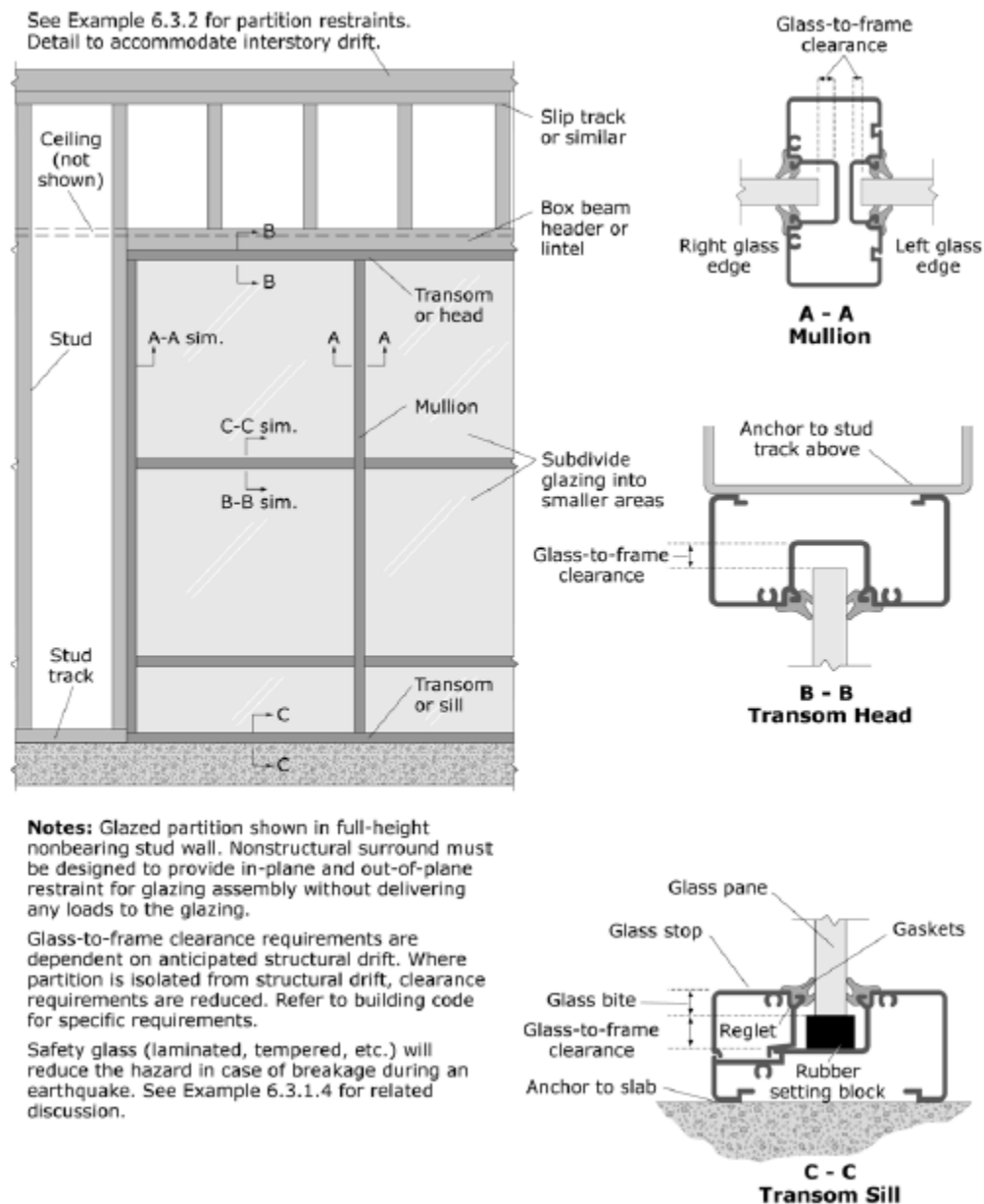


Figure G-5. Full-height Glazed Partition.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

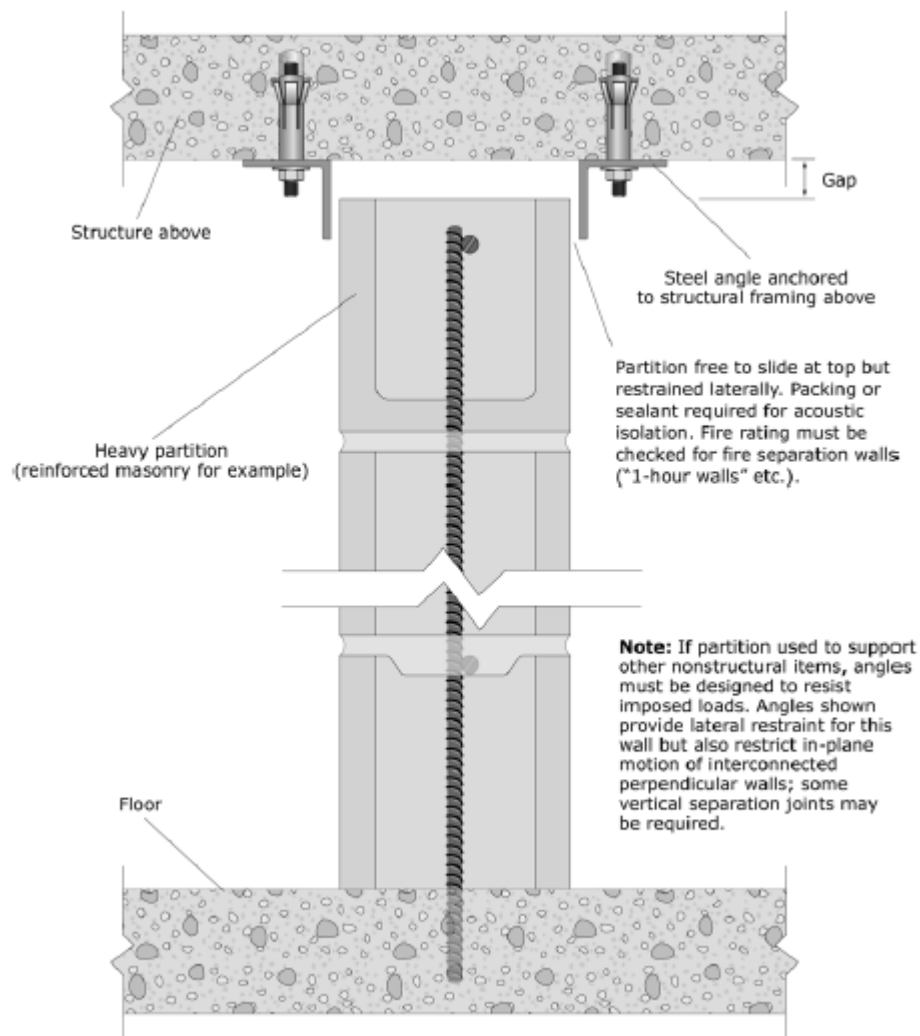


Figure G-6. Full-height Heavy Partition.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

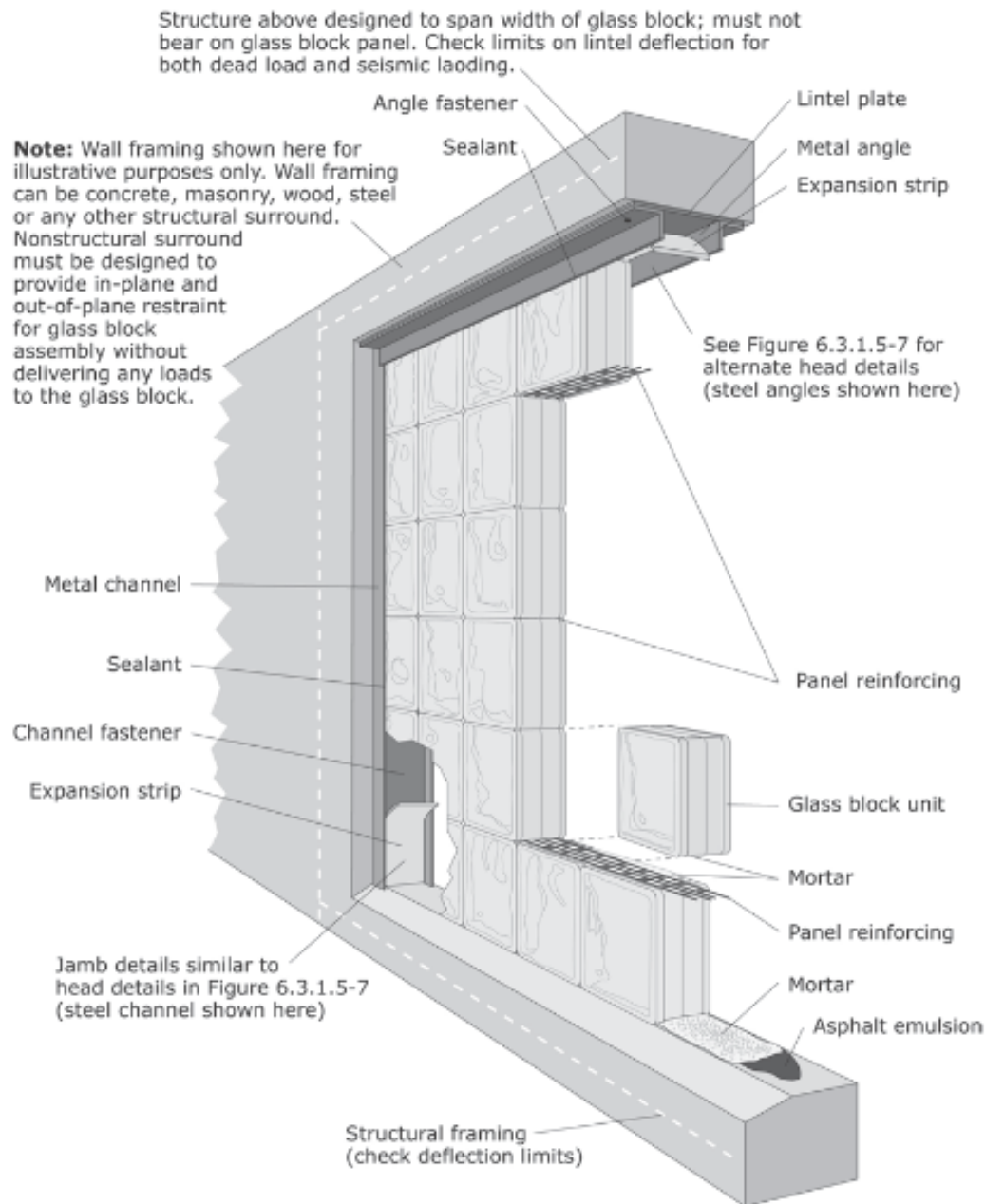
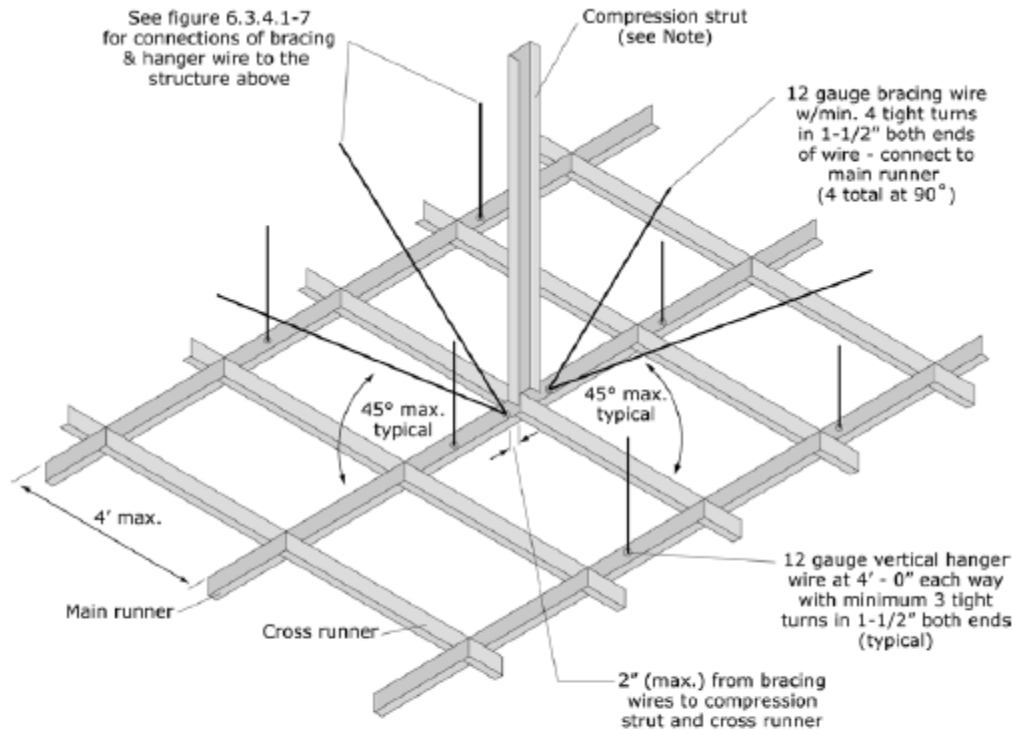


Figure G-7. Typical Glass Block Panel Details.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Washington State School Seismic Safety Assessments Project
Seismic Upgrades Concept Design Report – Burlington-Edison School District 100
Burlington-Edison High School, Gym/Fieldhouse Building - F-7 -



Figure G-8. Suspension System for Acoustic Lay-in Panel Ceilings – Edge Conditions.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Note: Compression strut shall not replace hanger wire. Compression strut consists of a steel section attached to main runner with 2 - #12 sheet metal screws and to structure with 2 - #12 screws to wood or 1/4" min. expansion anchor to structure. Size of strut is dependent on distance between ceiling and structure ($l/r \leq 200$). A 1" diameter conduit can be used for up to 6'; a 1-5/8" X 1-1/4" metal stud can be used for up to 10'

Per DSA IR 25-5, ceiling areas less than 144 sq. ft. or fire rated ceilings less than 96 sq. ft., surrounded by walls braced to the structure above do not require lateral bracing assemblies when they are attached to two adjacent walls. (ASTM E580 does not require lateral bracing assemblies for ceilings less than 1000 sq. ft.; see text.)

Figure G-9. Suspension System for Acoustic Lay-in Panel Ceilings – General Bracing Assembly.
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

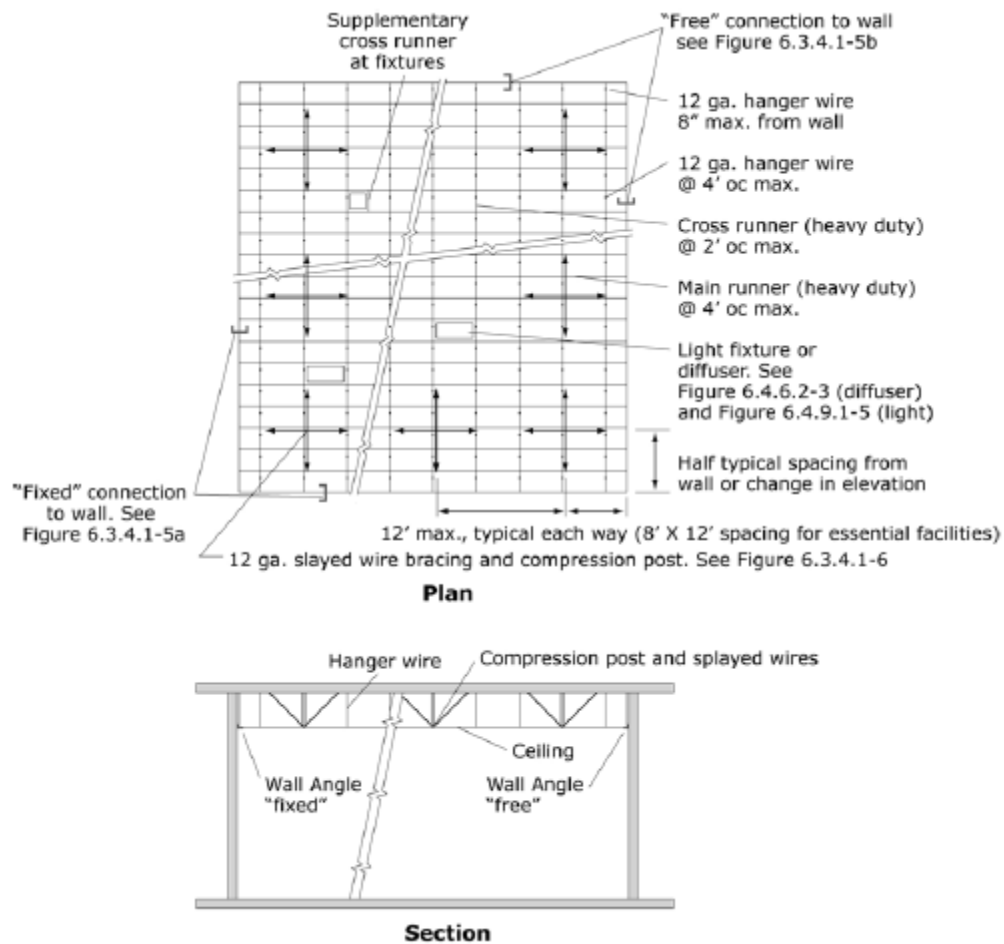


Figure G-10. Suspension System for Acoustic Lay-in Panel Ceilings – General Bracing Layout.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

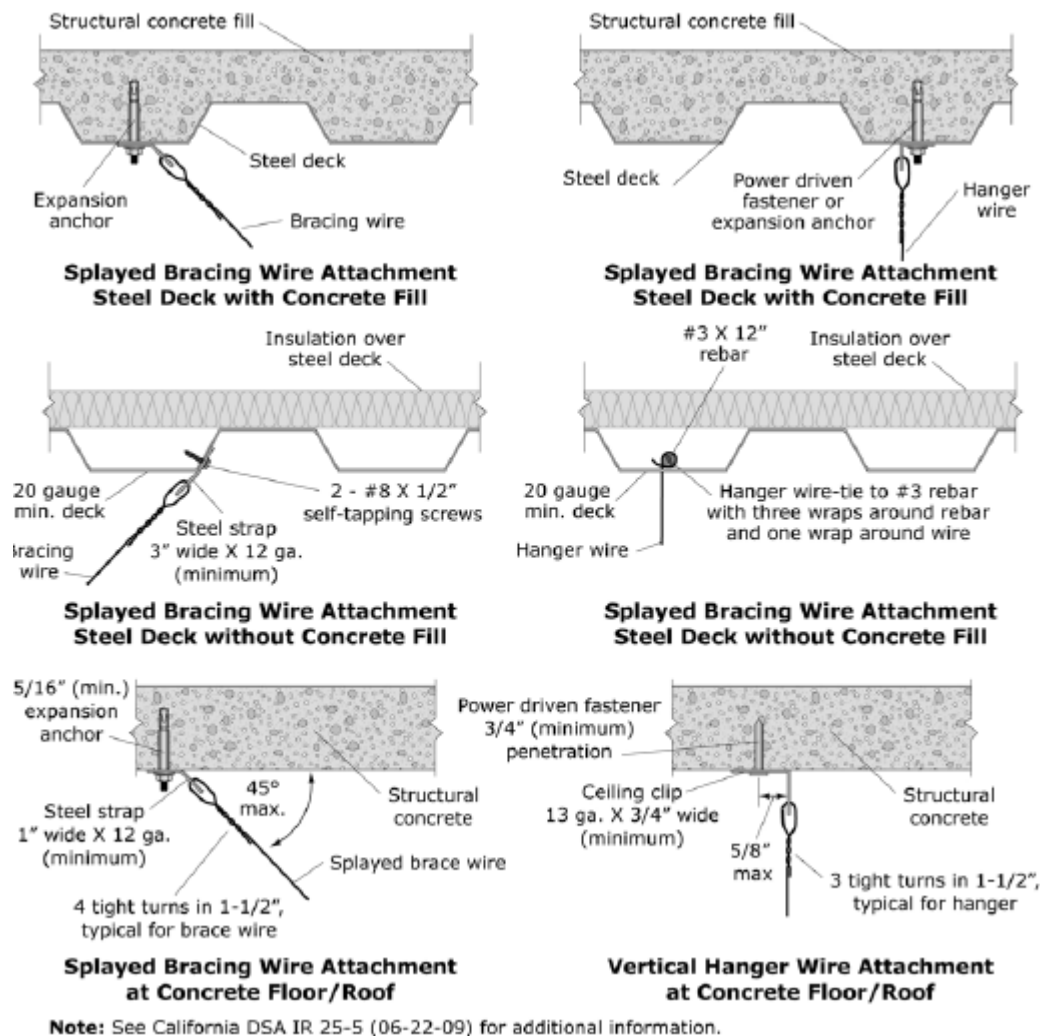
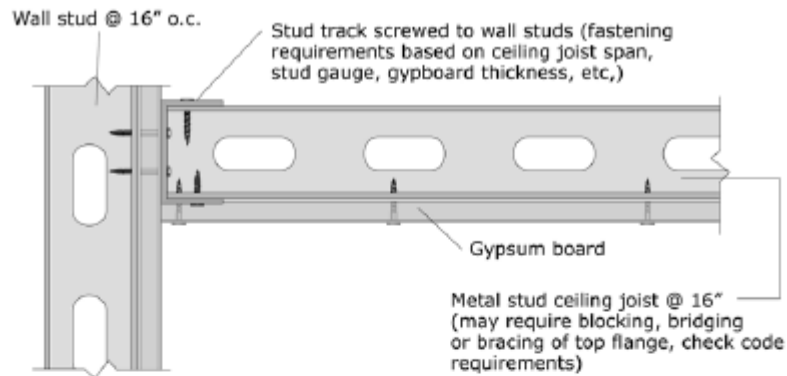
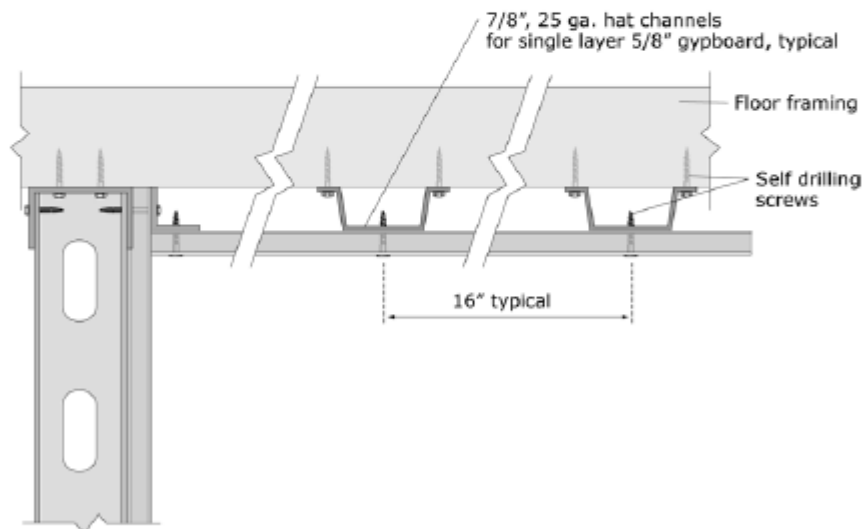


Figure G-11. Suspension System for Acoustic Lay-in Panel Ceilings – Overhead Attachment Details.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



a) Gypsum board attached directly to ceiling joists



b) Gypsum board attached directly to furring strips (hat channel or similar)

Note: Commonly used details shown; no special seismic details are required as long as furring and gypboard secured. Check for certified assemblies (UL listed, FM approved, etc.) if fire or sound rating required.

Figure G-12. Gypsum Board Ceiling Applied Directly to Structure.
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

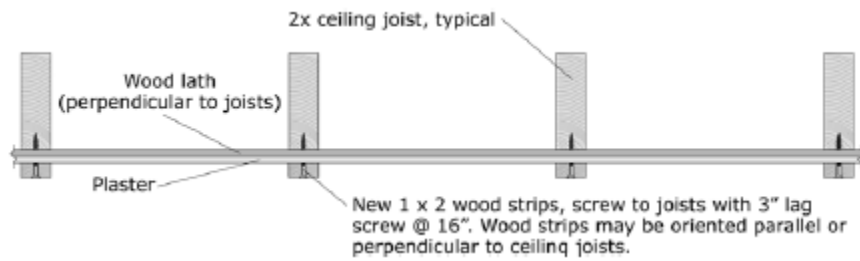


Figure G-13. Retrofit Detail for Existing Lath and Plaster.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

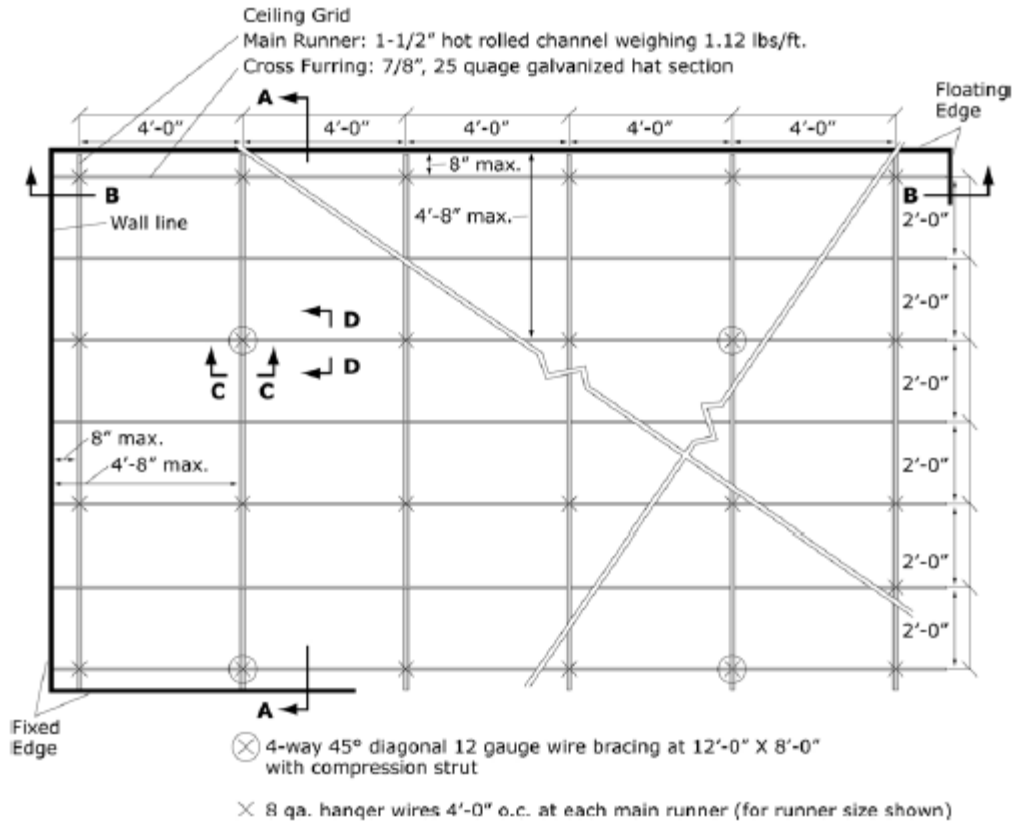


Figure G-14. Diagrammatic View of Suspended Heavy Ceiling Grid and Lateral Bracing.
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

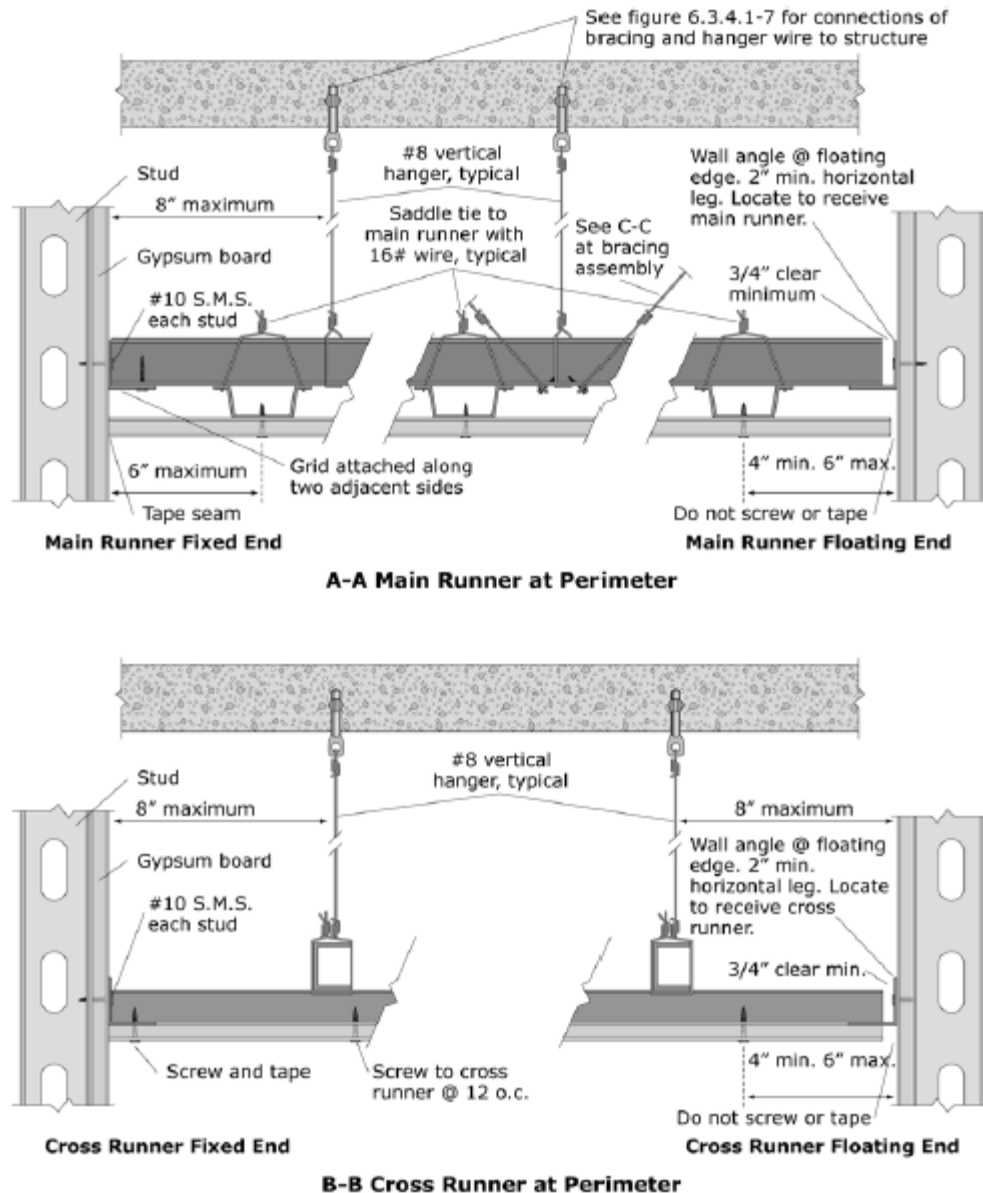
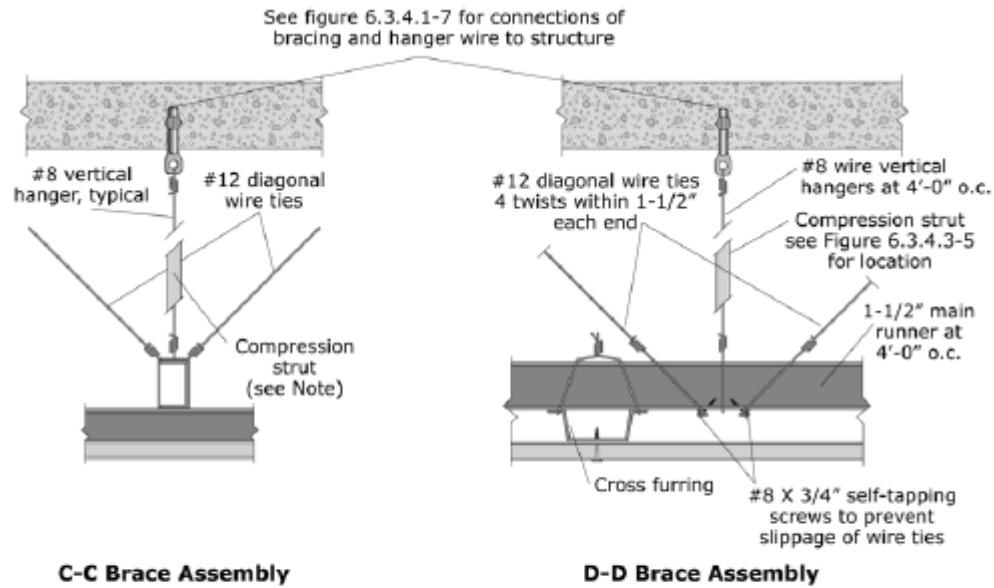


Figure G-15. Perimeter Details for Suspended Gypsum Board Ceiling.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Note: Compression strut shall not replace hanger wire. Compression strut consists of a steel section attached to main runner with 2 - #12 sheet metal screws and to structure with 2 - #12 screws to wood or 1/4" min. expansion anchor to concrete. Size of strut is dependent on distance between ceiling and structure ($l/r \leq 200$). A 1" diameter conduit can be used for up to 6', a 1-5/8" X 1-1/4" metal stud can be used for up to 10'. See figure 6.3.4.1-6 for example of bracing assembly.

Figure G-16. Details for Lateral Bracing Assembly for Suspended Gypsum Board Ceiling.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Light Fixtures

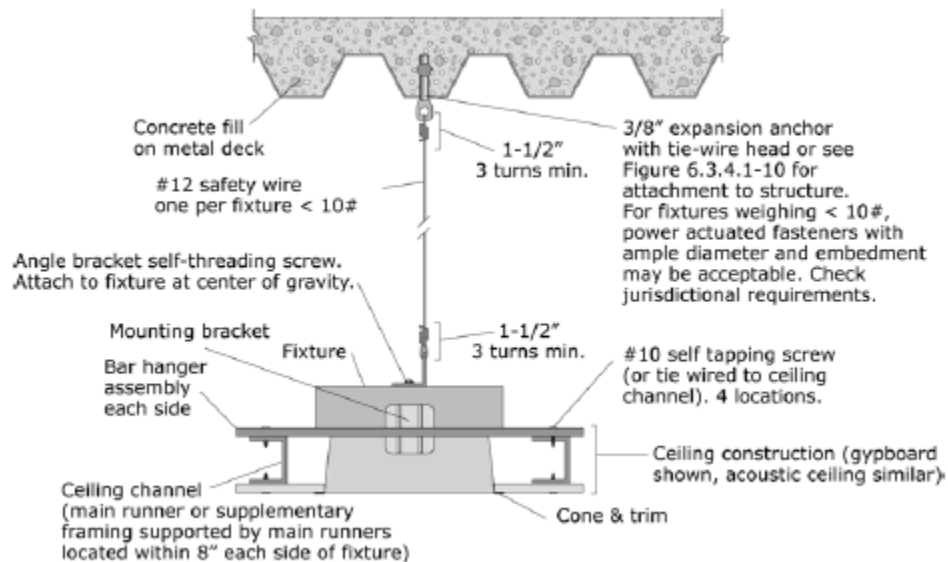


Figure G-17. Recessed Light Fixture in suspended Ceiling (Fixture Weight < 10 pounds).
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

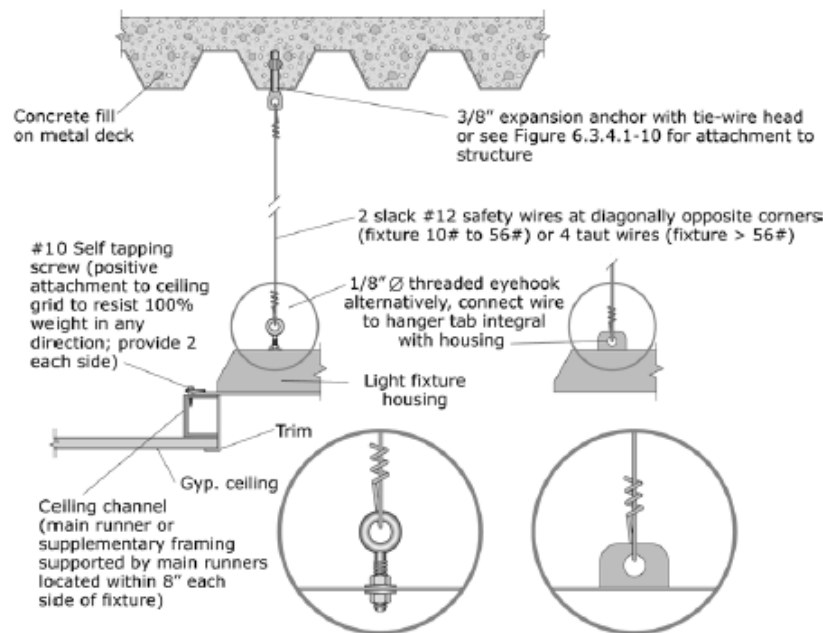


Figure G-18. Recessed Light Fixture in suspended Ceiling (Fixture Weight 10 to 56 pounds).
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

Contents and Furnishings

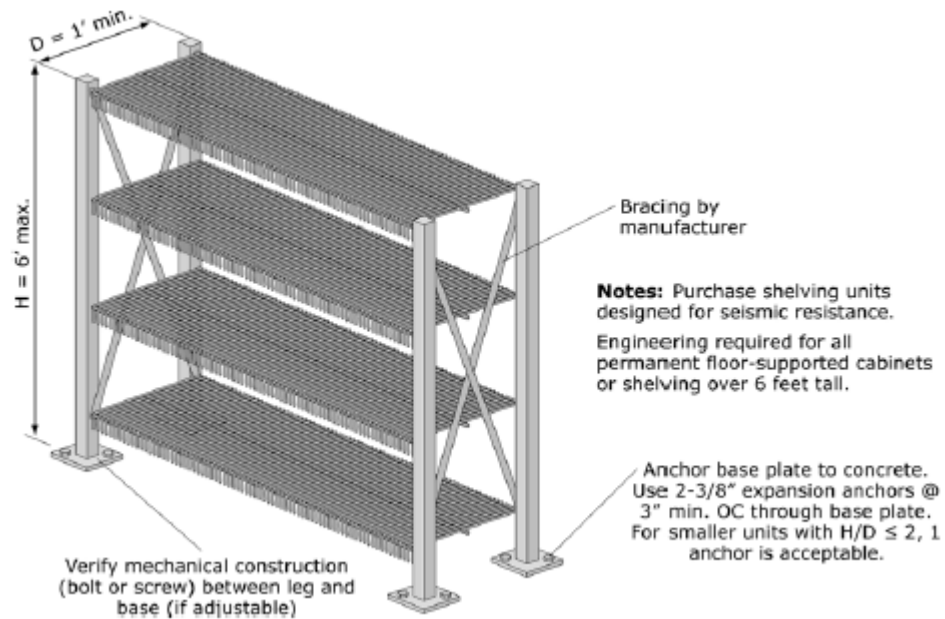
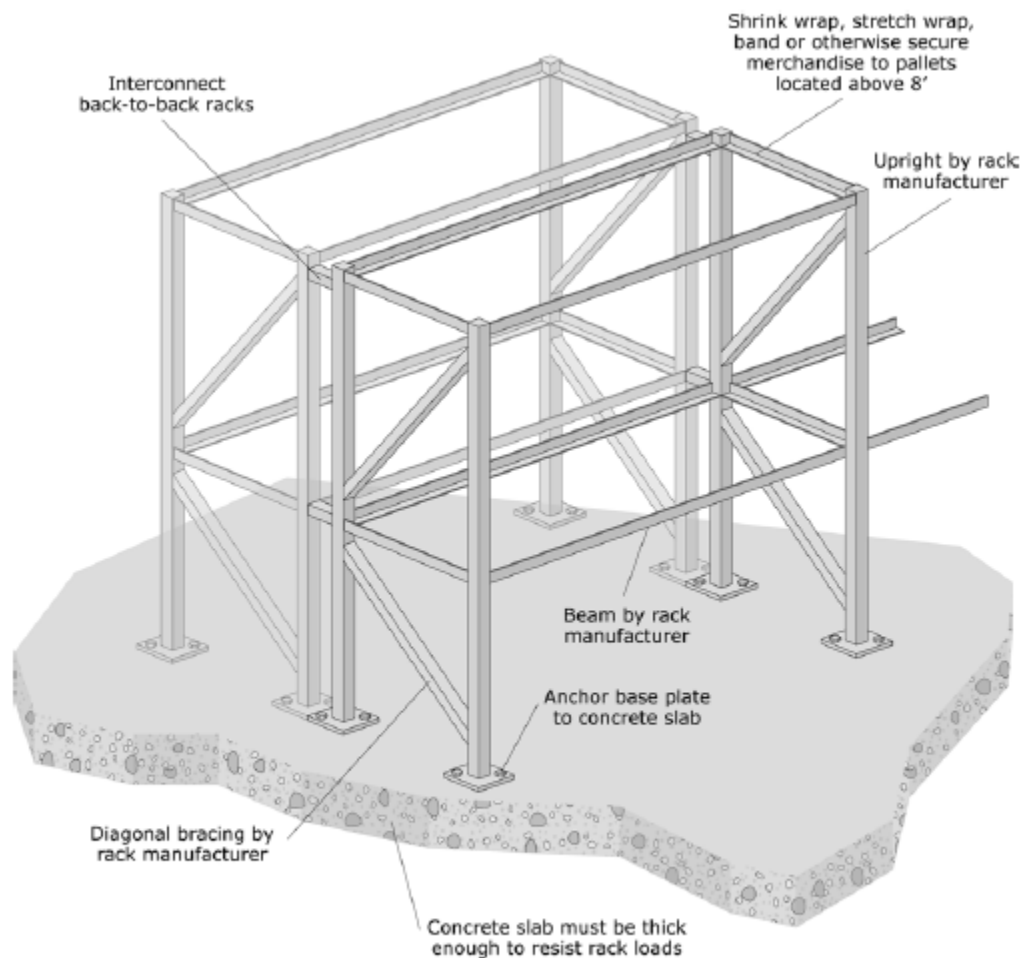


Figure G-19. Light Storage Racks.
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)



Note: Purchase storage racks designed for seismic resistance. Storage racks may be classified as either nonstructural elements or nonbuilding structures depending upon their size and support conditions. Check the applicable code to see which provisions apply.

Figure G-20. Industrial Storage Racks.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

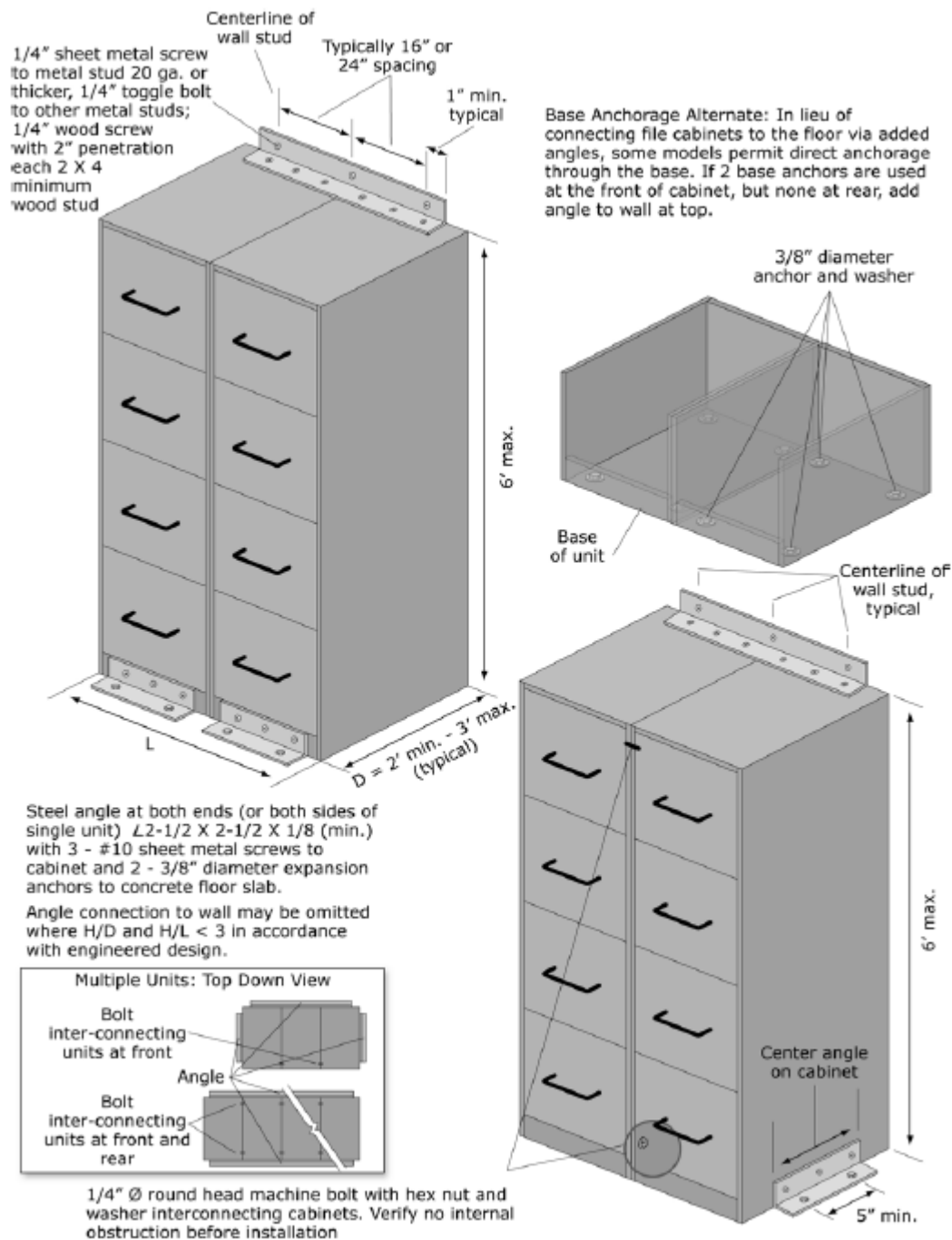


Figure G-21. Wall-mounted File Cabinets.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

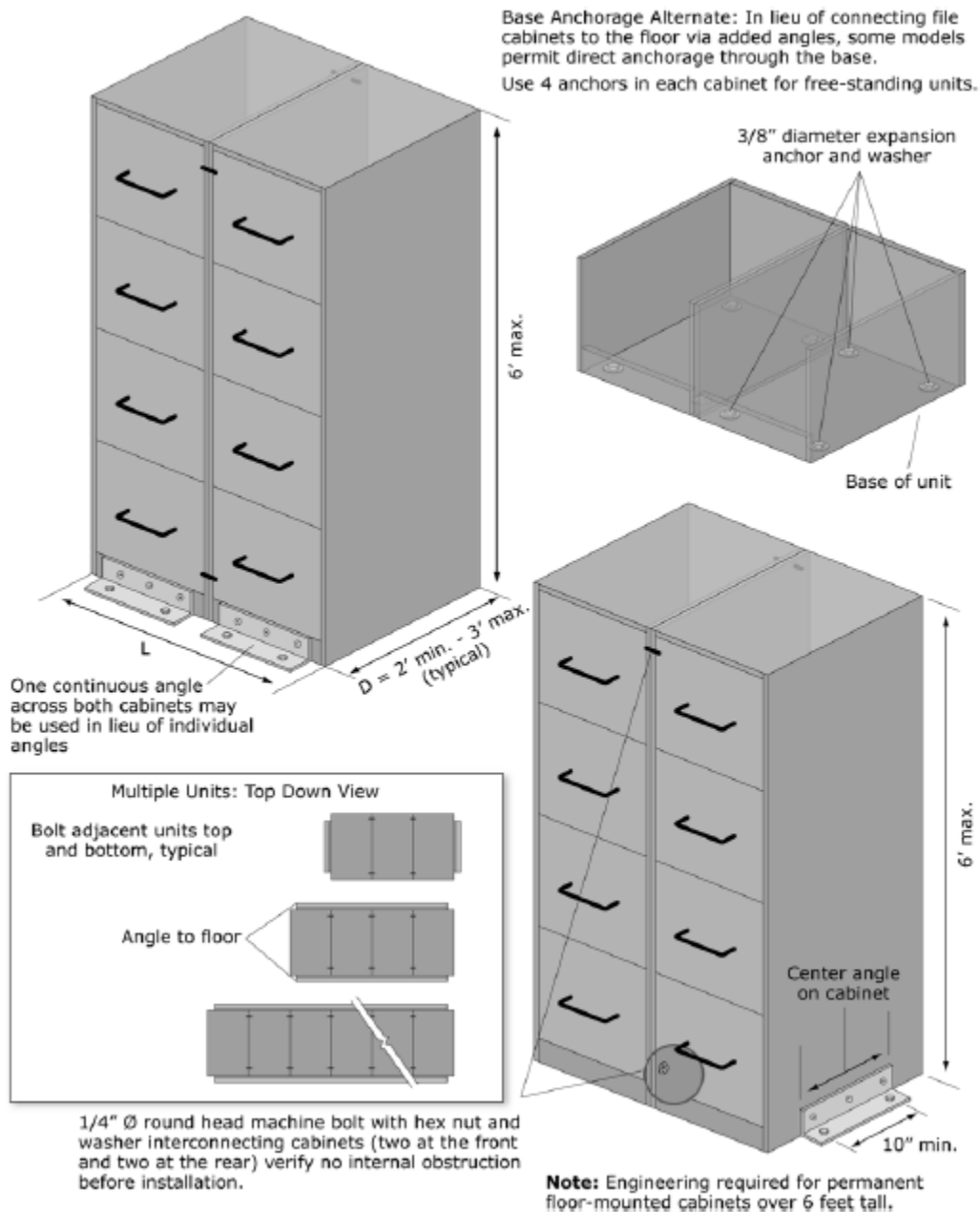
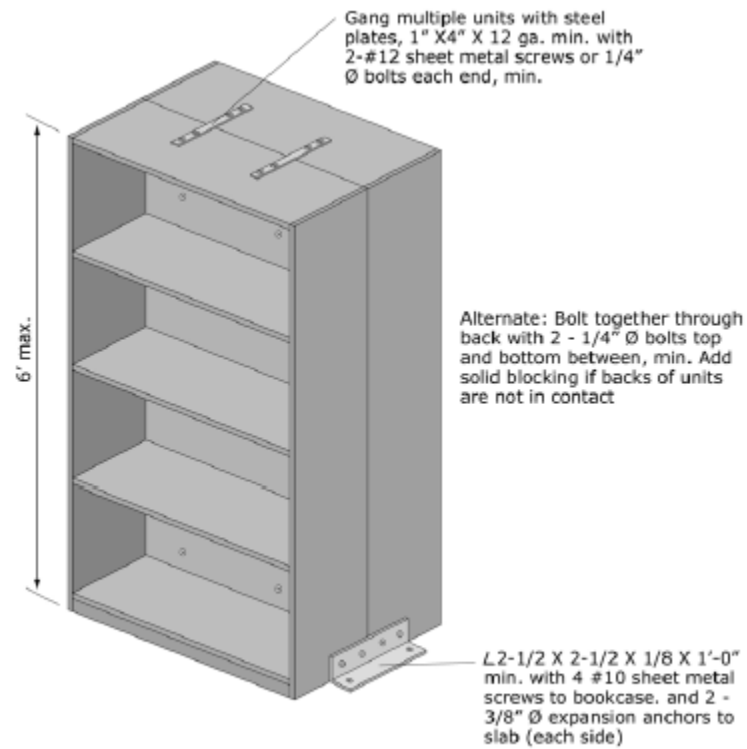


Figure G-22. Base Anchored File Cabinets.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Note: Engineering required for all permanent floor-supported cabinets or shelving over 6 feet tall. Details shown are adequate for typical shelving 6 feet or less in height.

Figure G-23. Anchorage of Freestanding Book Cases Arranged Back to Back.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

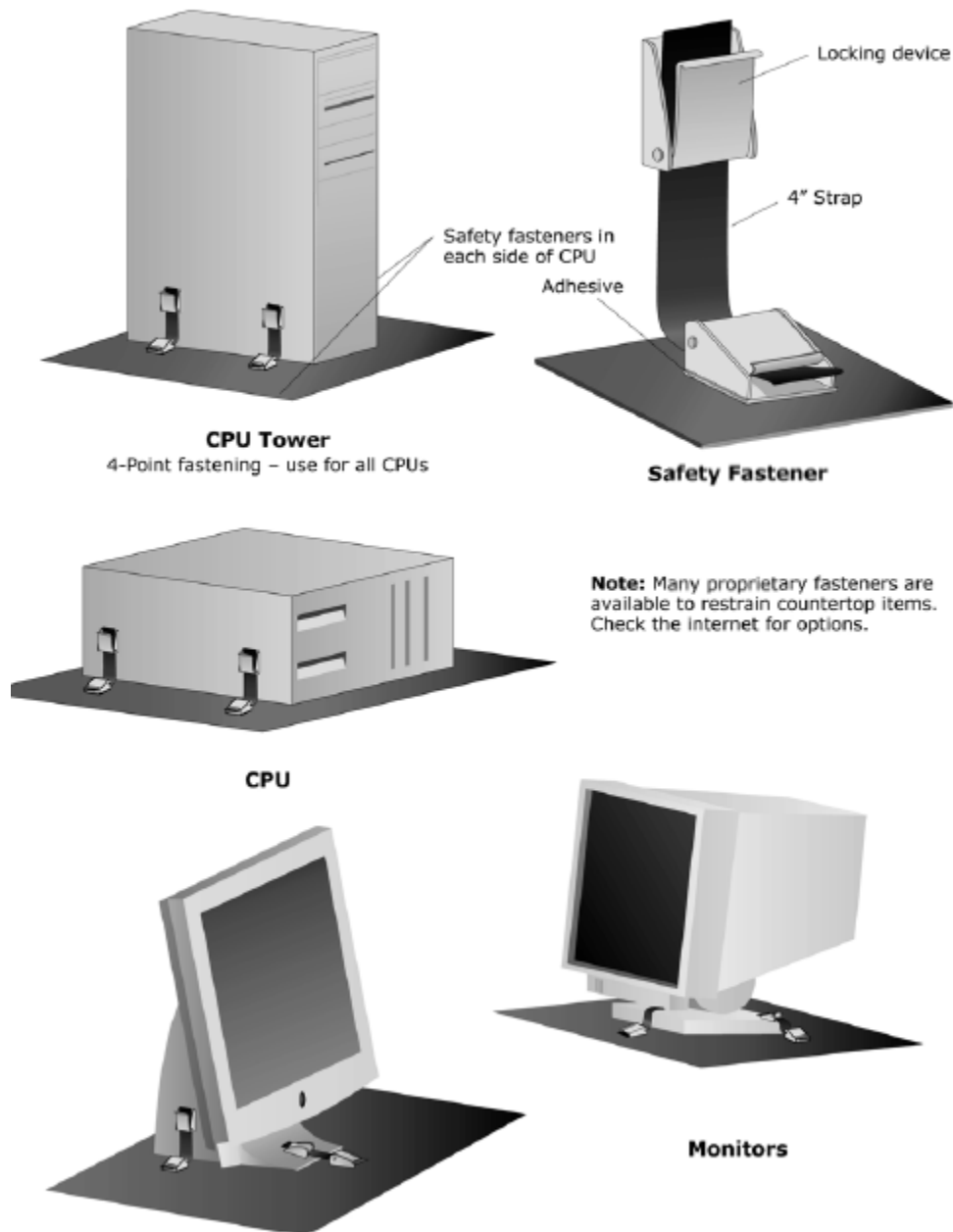
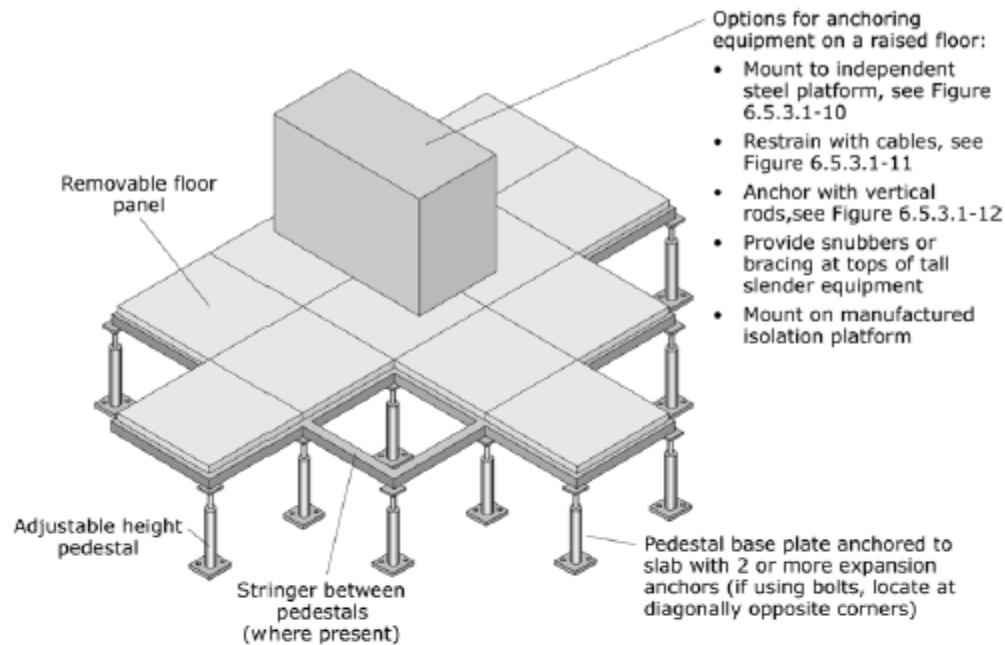
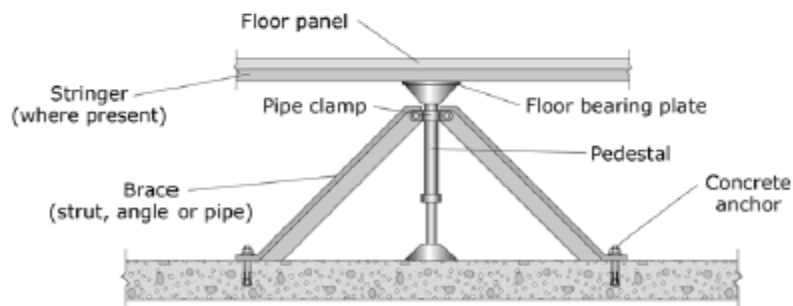


Figure G-24. Desktop Computers and Accessories.
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)



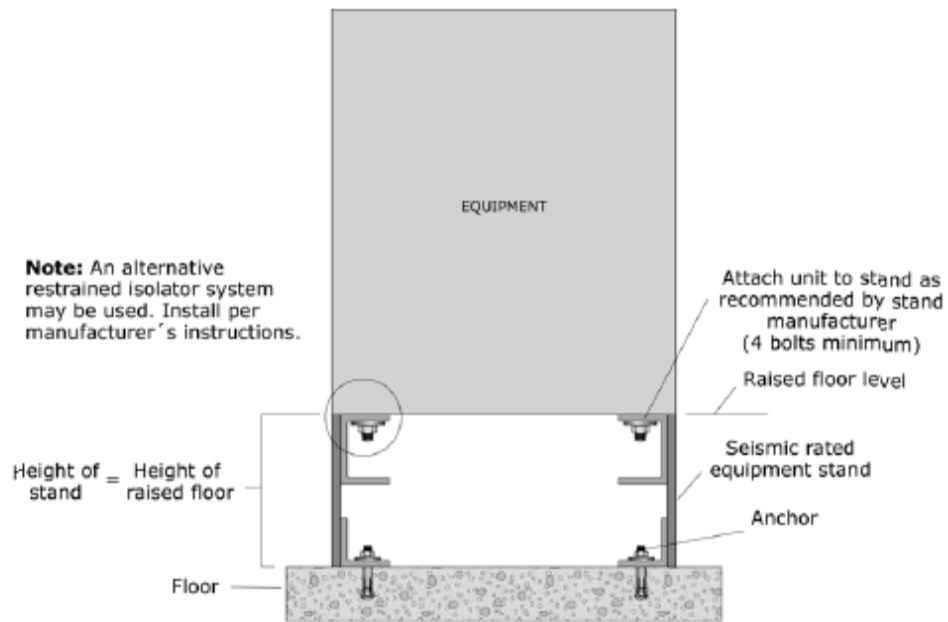
Cantilevered Access Floor Pedestal



Braced Access Floor Pedestal (use for tall floors or where pedestals are not strong enough to resist seismic forces)

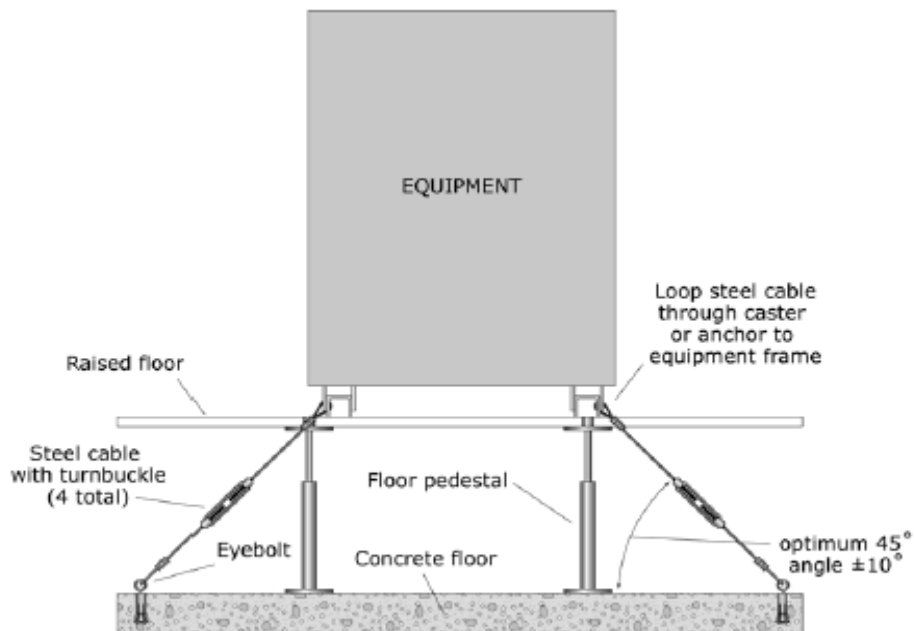
Note: For new floors in areas of high seismicity, purchase and install systems that meet the applicable code provisions for "special access floors."

Figure G-25. Equipment Mounted on Access Floor.
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)



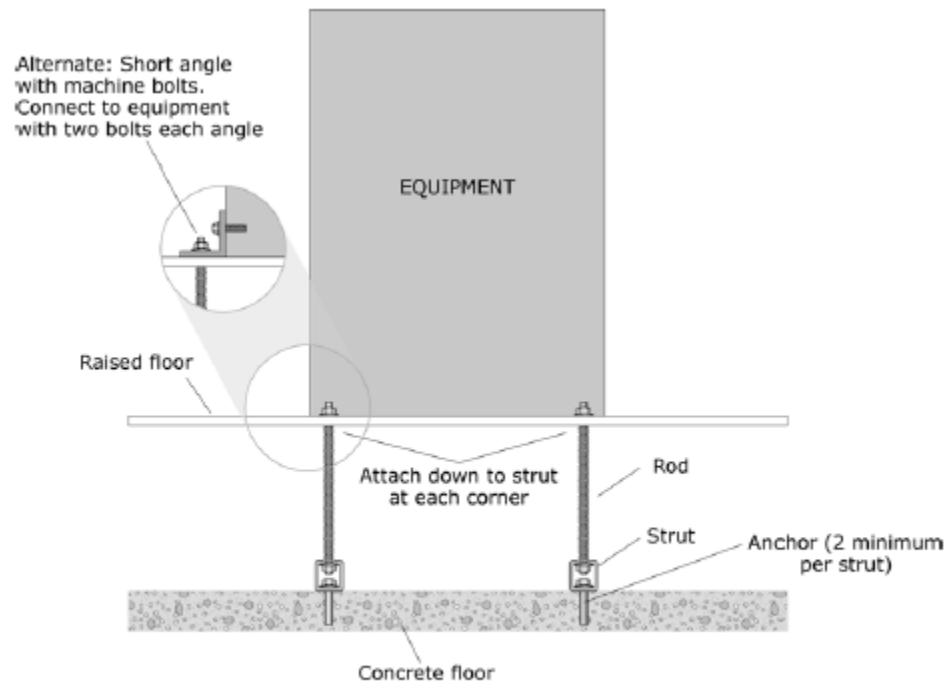
Equipment installed on an independent steel platform within a raised floor

Figure G-26. Equipment Mounted on Access Floor – Independent Base.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Equipment restrained with cables beneath a raised floor

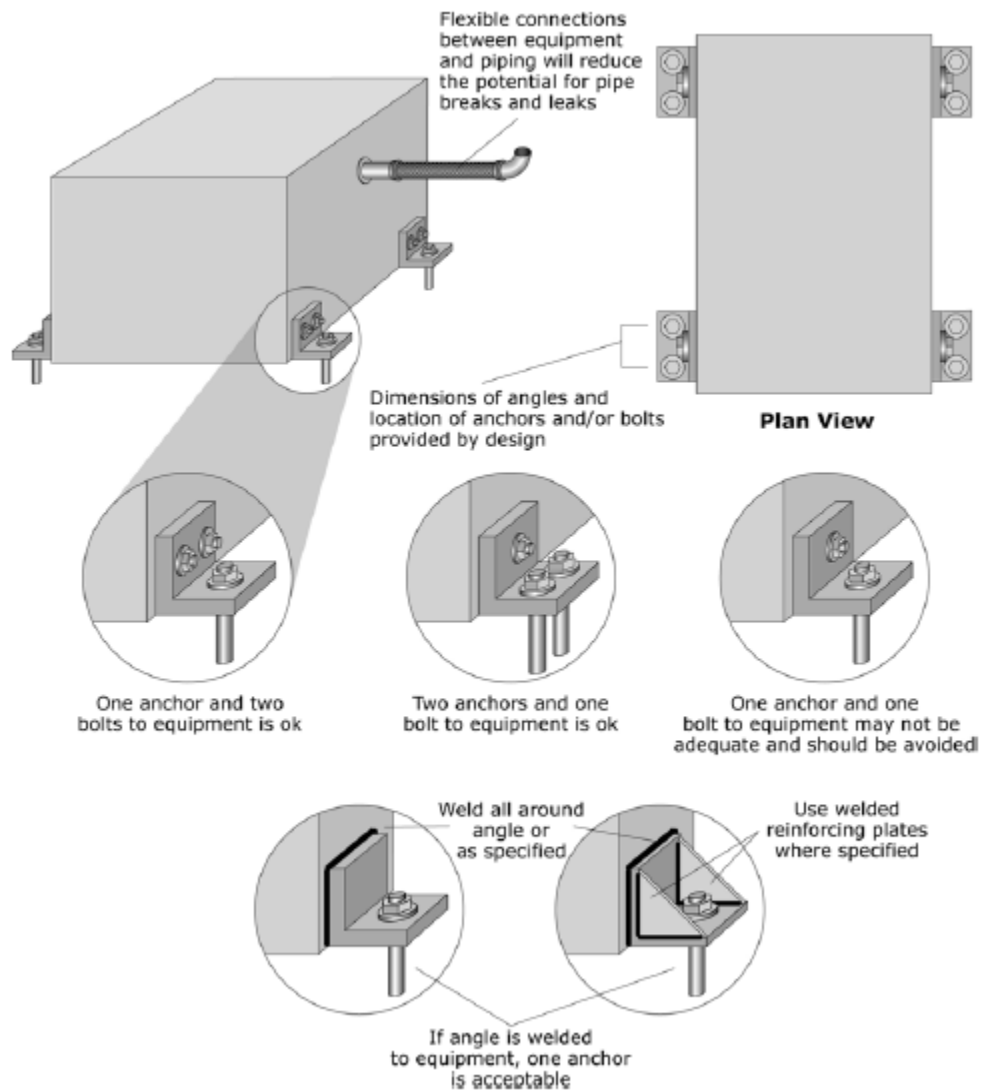
Figure G-27. Equipment Mounted on Access Floor – Cable Braced.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)



Equipment anchored with vertical rods beneath a raised floor

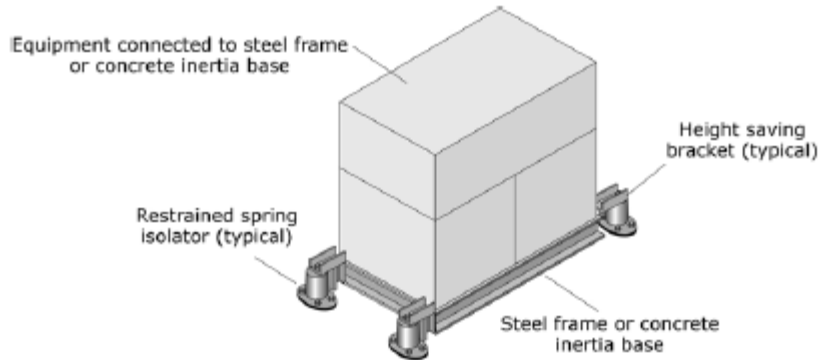
Figure G-28. Equipment Mounted on Access Floor – Tie-down Rods.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Mechanical and Electrical Equipment

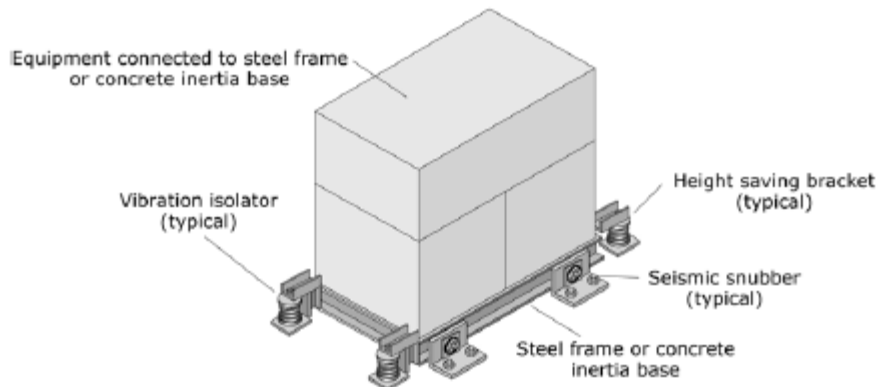


Note: Rigidly mounted equipment shall have flexible connections for the fuel lines and piping.

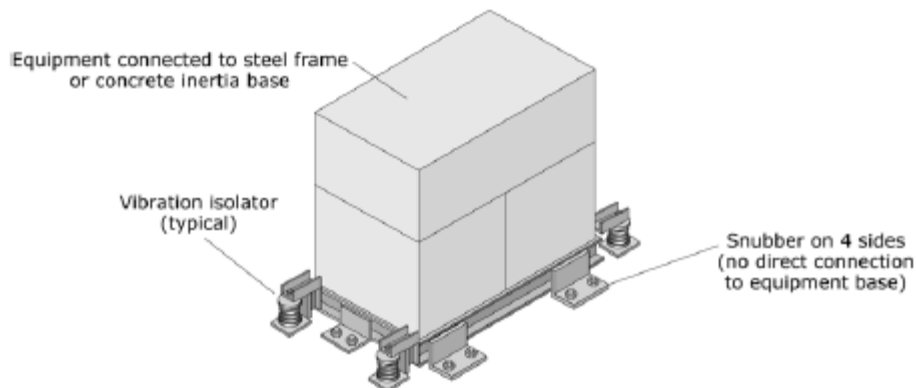
Figure G-29. Rigidly Floor-mounted Equipment with Added Angles.
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)



Supplemental base with restrained spring isolators



Supplemental base with open springs and all-directional snubbers



Supplemental base with open springs and one-directional snubbers

Figure G-30. HVAC Equipment with Vibration Isolation.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

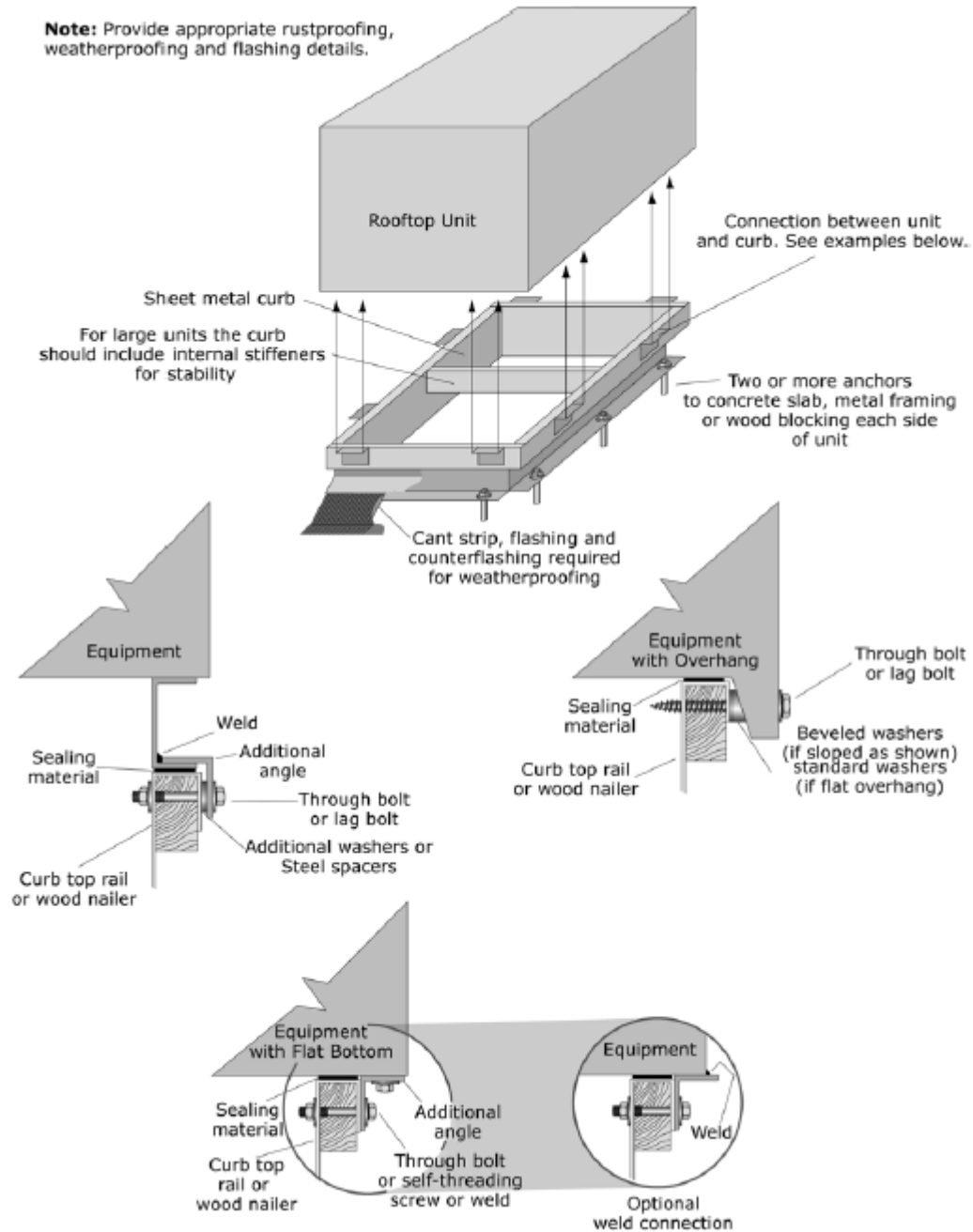


Figure G-31. Rooftop HVAC Equipment.

(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

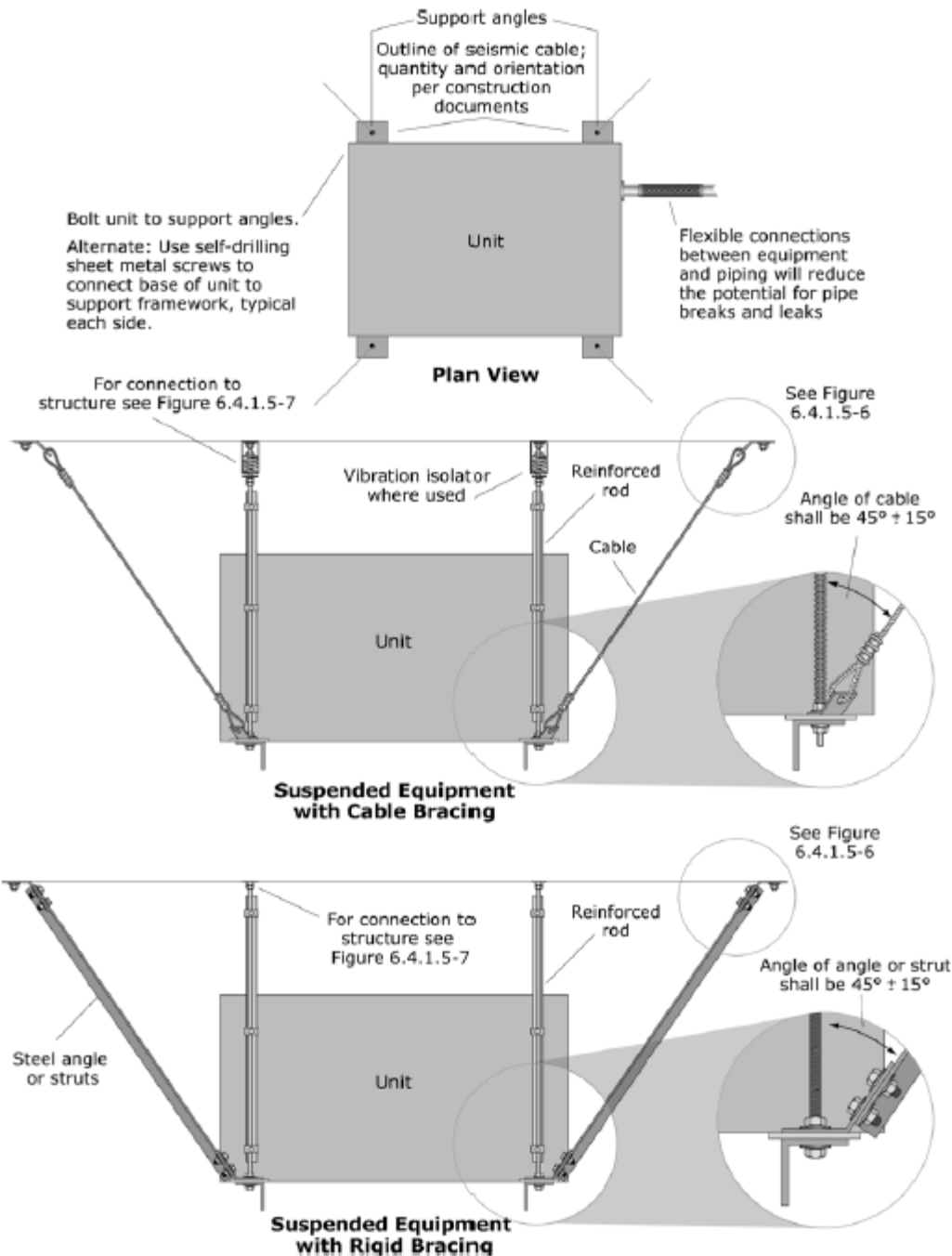


Figure G-32. Suspended Equipment.
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

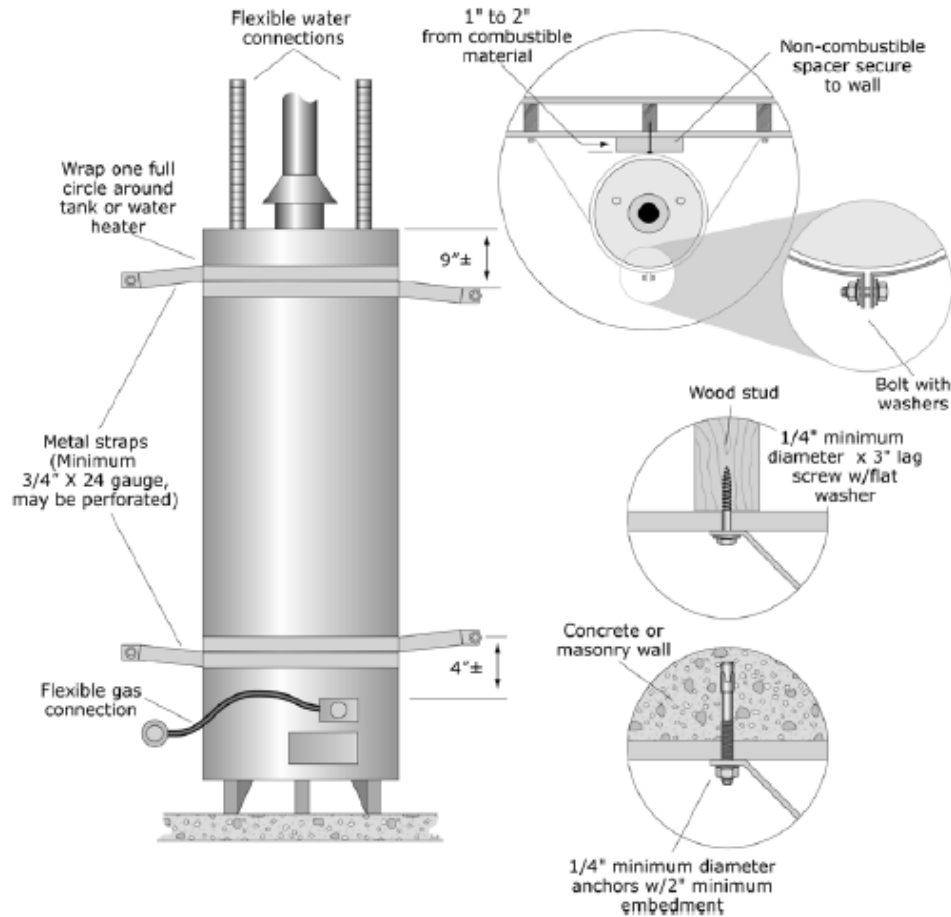


Figure G-33. Water Heater Strapping to Backing Wall.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

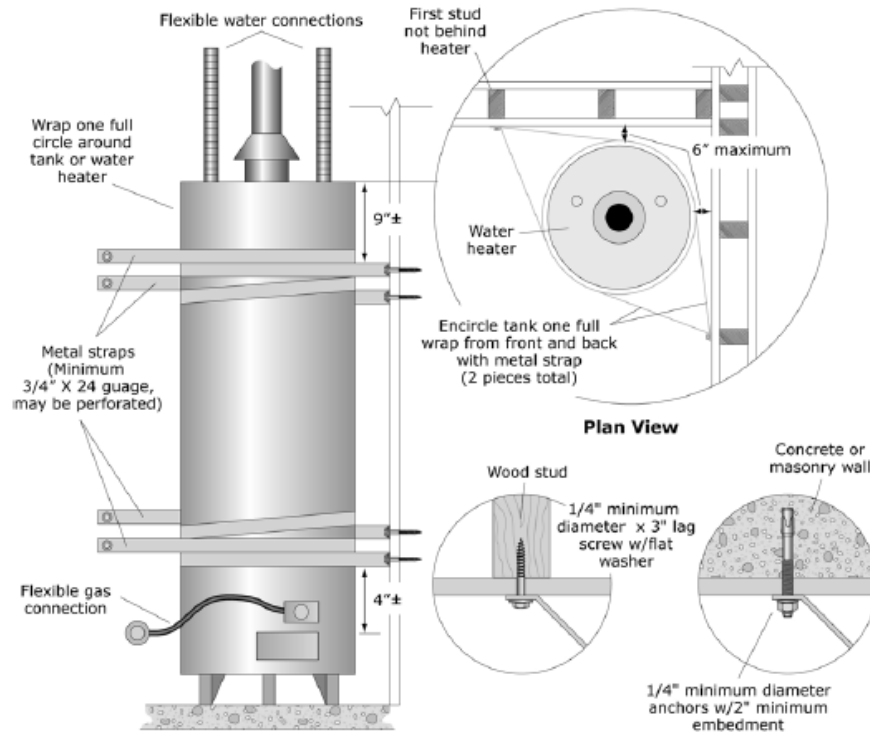


Figure G-34. Water Heater – Strapping at Corner Installation.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

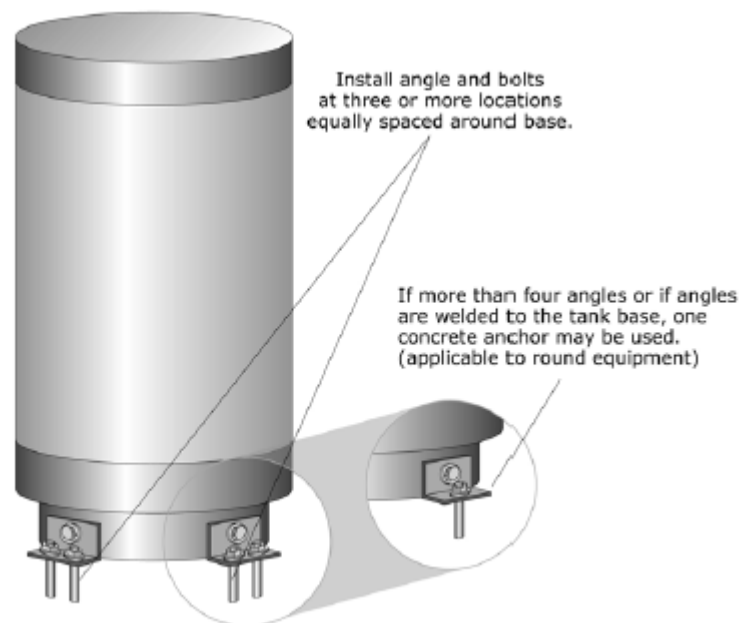


Figure G-35. Water Heater – Base Mounted.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

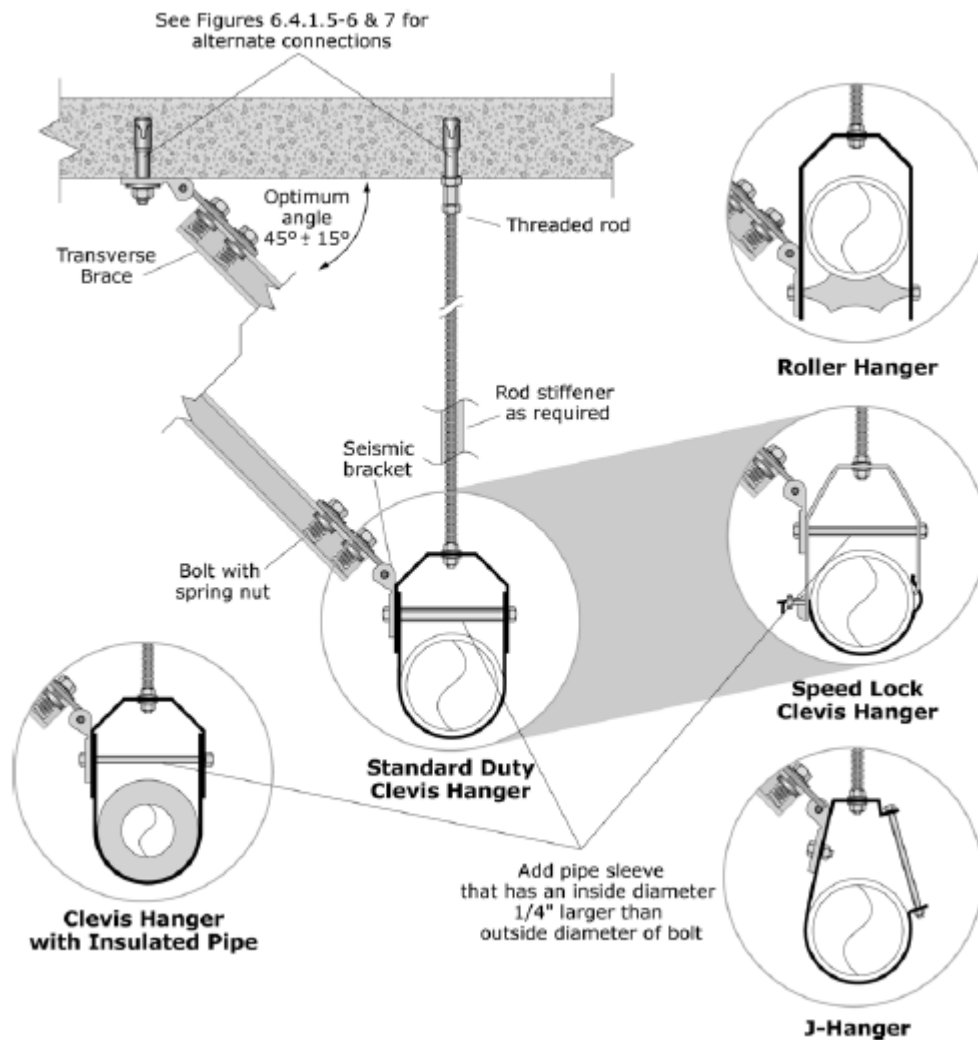


Figure G-36. Rigid Bracing – Single Pipe Transverse.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

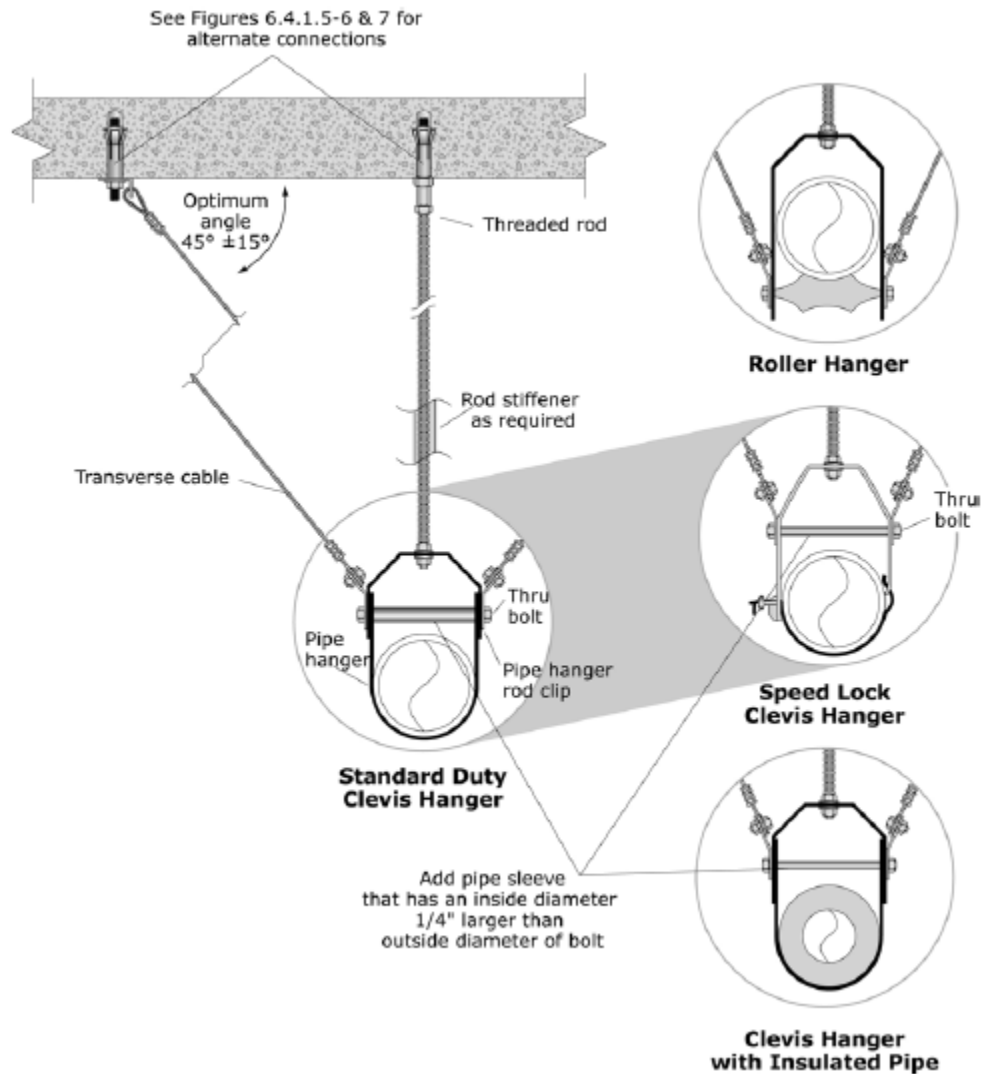


Figure G-37. Cable Bracing – Single Pipe Transverse.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

Electrical and Communications

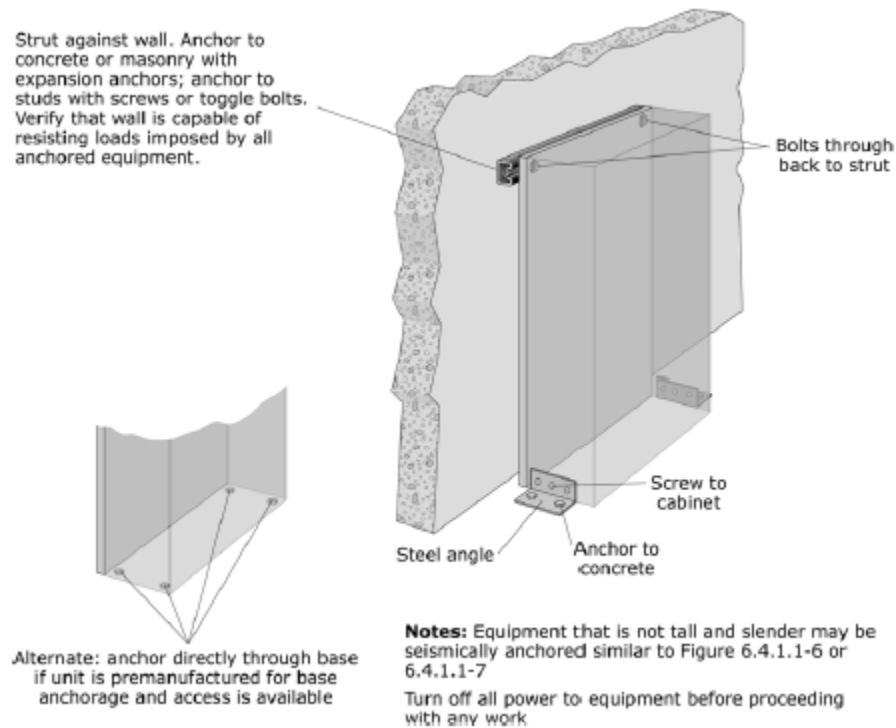


Figure G-38. Electrical Control Panels, Motor Controls Centers, or Switchgear.
(FEMA E-74, 2012, *Reducing the Risks of Nonstructural Earthquake Damage*)

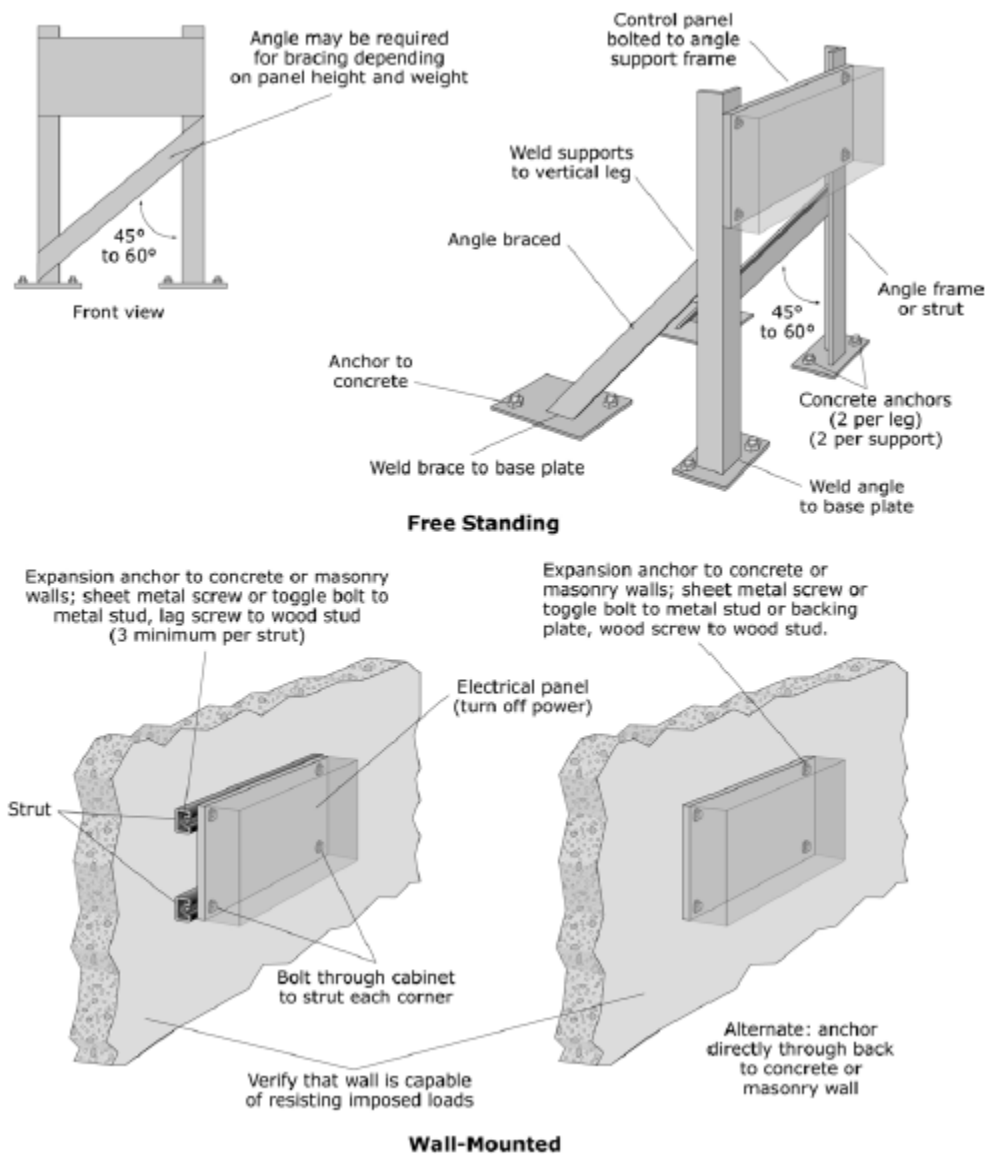


Figure G-39. Freestanding and Wall-mounted Electrical Control Panels, Motor Controls Centers, or Switchgear.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)

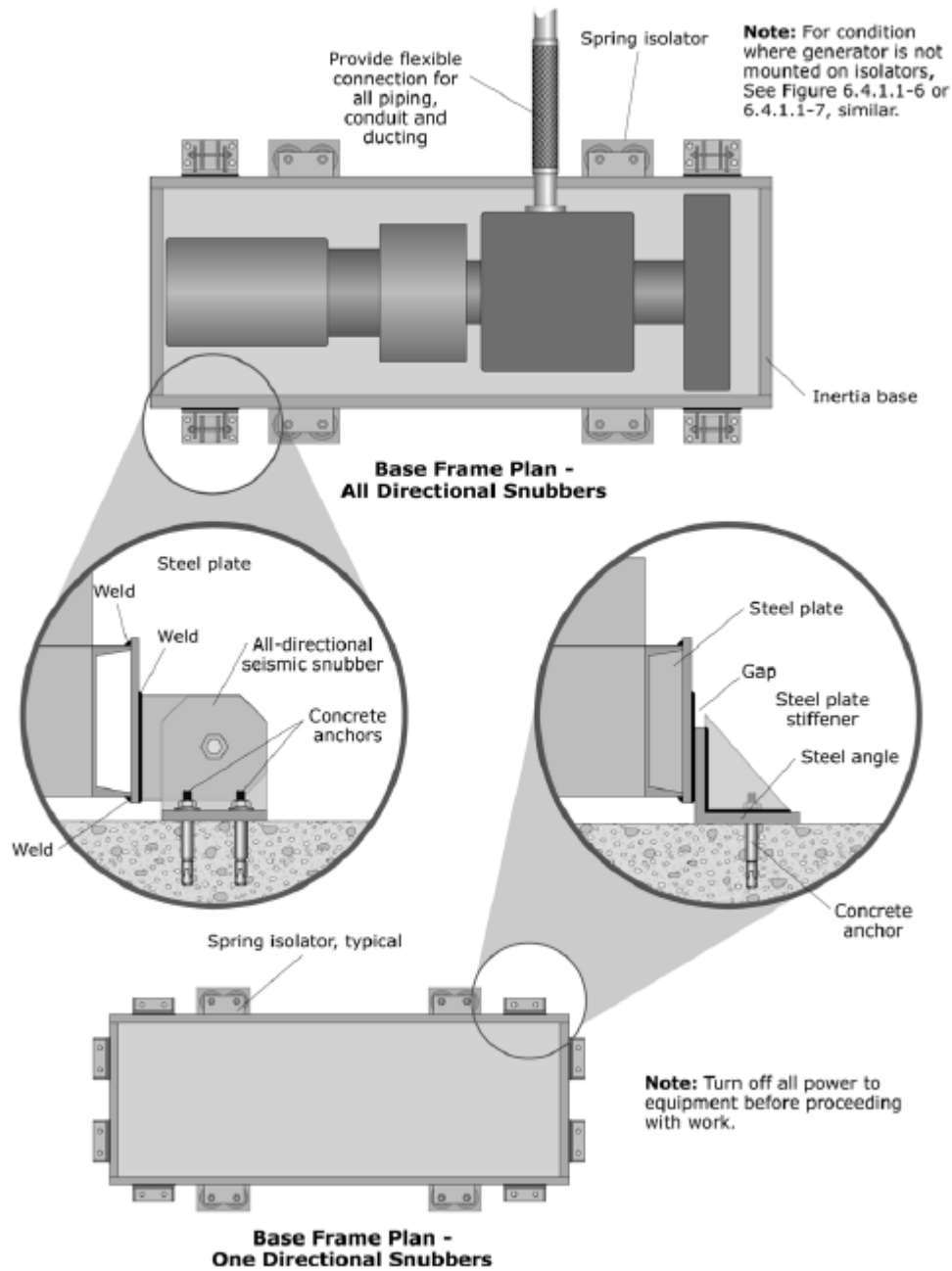


Figure G-40. Emergency Generator.
(FEMA E-74, 2012, Reducing the Risks of Nonstructural Earthquake Damage)